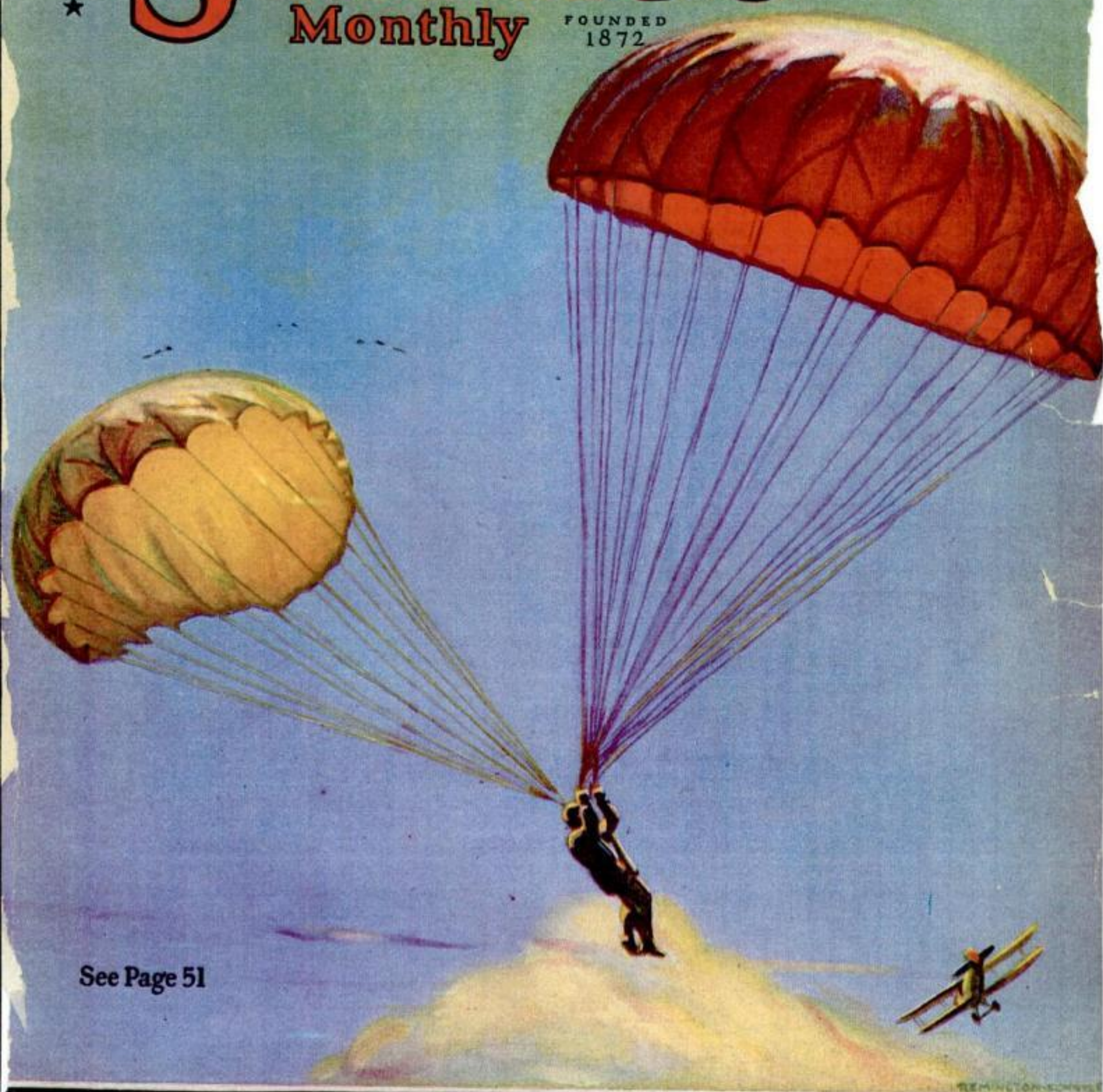


# Popular Science

★ Monthly

FOUNDED  
1872



See Page 51

## MARVELS WE MAY SEE IN 1927

JANUARY

By 20 Famous Scientists - Page 20

25 CENTS





## look inside that Christmas Radio Set

**T**HE equipment is as important as the set. The distance reach of a set depends a great deal on the tube in the detector socket. The over-all performance of a set depends very much on the tubes in every socket. The volume and tone quality you will get are dependent upon the tube in the last audio stage. In every point, the tubes are as important as the set. And everyone who realizes this insists on genuine RCA Radiotrons.

The research laboratories of RCA, General Electric and Westinghouse have developed Radiotrons to new accomplishment, year by year. And the manufacturing skill of these same companies keeps RCA Radiotrons far in the lead in accurate making.

*Be sure, when you buy a Christmas radio set, that you are getting genuine RCA Radiotrons with it. You can tell by the RCA mark inside the glass at the top. Or take out the tube, and look at its base.*

### Extra! Extra! Gift Ideas for Radio fans

A "spare" Radiotron—genuine RCA Radiotron, of course—of the type he uses.

A power Radiotron UX-112, UX-171 or UX-210 for bigger volume and finer tone.

A special detector Radiotron UX-200-A for storage battery sets—for longer distance reach.

Ask any dealer all about these Radiotrons—he'll tell you which to get. But be sure it's a genuine RCA Radiotron, if it's to be worthy of gift giving.

**RADIO CORPORATION  
OF AMERICA**  
New York Chicago  
San Francisco

# RCA Radiotron

MADE BY THE MAKERS OF THE RADIOLA



# Ferguson

**I**N MANY receivers one may experience excellent "tone quality." With **FERGUSON** you are conscious of something more: a degree of *fullness* that gives you *each note from every instrument* in perfect timbre. Not mere music, but the *soul* of the artist seems to come into your living room.

One Tuning Control—Calibrated in Meters gives you, in a moment, the program to suit your mood.

Complete shielding of all tuning elements gives this 6-tube Receiver its marked selectivity.

See, hear, compare!

**J. B. FERGUSON, INC.**

225 West 57th Street  
New York, N.Y.

The FERGUSON  
Model Ten . . . . . \$110.00  
With table, as shown, 147.50  
(Ten per cent increase west  
of the Rockies)



No Seasonal Models—  
Continually Developing Refinements

*The Gold Standard of Radio Receivers* ®





# AN IDEA OF YOUR OWN

## AN EDITORIAL

A LETTER lies on my desk. It is from a young man in California who wants me to tell him how he can become an inventor. To mind comes a picture of Alexander Graham Bell, white-haired, kindly. A young newspaper reporter had asked him a similar question. The father of the telephone smiled a bit as he puffed slowly on a stubby pipe.

"Young man," he said in words that he weighed as a pharmacist weighs his drugs, "get an idea of your own. Be sure it is a good one. Then put every bit of energy you have into it. And stick to it!"

Think that answer over. "Good advice for anybody, in any walk of life. "Get an idea of your own!" Get it anywhere. Ideas are as plentiful as dried leaves in the fall, but unfortunately, to most people, are as worthless. Every idea kicked aside may be an invention in the abstract.

A dictating machine that will turn out letters ready for mailing. Window glass that can be seen through from the inside but not from the outside. Untarnishable silverware. A practical machine to utilize the energy in the sun's rays. A regulator that will control instantly the temperature of the water in the bathroom faucets. These are just a few of the challenges to inventive genius to be found on every street, in every home and in every office.

ONCE you have your idea, be sure it is good. Utility, practical application, and the satisfying of some human need—these are the yardsticks by which it should be measured. Ask yourself if it extends one of the five senses nature has given us. Will it make our lives broader, easier or happier? If so, the demand is great—in transportation, motion pictures, radio, electric-

ity—in almost every phase of human activity.

But to put behind an idea every bit of energy you are capable of and to stick to it with your whole heart and soul—that takes courage, the quality in human beings that makes for the difference between success and failure.

Mr. Bell faced prejudice and closed minds for years before his telephone was generally accepted. It took courage for George Westinghouse, whose story is told on page 31 of this issue, to stick to his air brake idea after experts told him it was impractical. It took courage for Edison to cling to his incandescent lamp when scientists of repute jeered at the idea. It took courage for Robert Fulton to face the ridicule his steamboat aroused. And it took courage for Henry Ford to laugh when people called him an impractical dreamer. Timidity is about as useful to an inventor as a last year's ice cream soda.

EVERY important invention has been confronted on every side by skeptics. People like best the things they know about. A "learned" committee once opposed the construction of a railroad on the ground that an engine in a wagon couldn't work it forward with as much advantage as horses on a road. There were once laws in American communities against bathtubs. People attacked the drivers of our first automobiles. Inventive accomplishment frequently means the ability to face derision fearlessly.

I'm telling that young Californian to listen and think; to examine each idea that comes to him as carefully as a mother examines her first-born. And then, if he chooses an idea the world really needs, and nurtures it with energy and intelligence, he need never worry about the high cost of beefsteak.—S.N.B.



# The new Balkite Combination supplies all radio power automatically from the light socket



## A New Balkite "B" at \$27.50

Eliminates "B" batteries and supplies "B" current from the light socket. Three new models. Balkite "B"-W at \$27.50 for sets of 5 tubes or less requiring 67 to 90 volts. Balkite "B"-X for sets of 8 tubes or less; capacity 30 milliamperes at 135 volts — \$42. Balkite "B"-Y for any radio set; capacity 40 milliamperes at 150 volts — \$69. (In Canada: "B"-W \$39; "B"-X \$59.50; "B"-Y \$96.)



## The New Balkite Charger

MODEL J. Has two rates. A low trickle charge rate and a high rate for rapid charging. Can thus be used either as a trickle or as a high rate charger. Noiseless. Rates: with 6-volt battery, 2.5 and .5 amperes; with 4-volt battery, .8 and .2 ampere. Price \$19.50. West of Rockies \$20. (In Canada \$27.50.)



## Balkite Trickle Charger, \$10

MODEL K. With 6-volt "A" batteries can be left on continuous charge thus automatically keeping the battery at full power. With 4-volt batteries can be used as an intermittent charger. Or as a trickle charger if a resistance is added. Rate .5 ampere. Price \$10. West of Rockies \$10.50. (In Canada \$15.)

All Balkite Units operate from 110-120 volt, 50-60 cycle AC. The Balkite Charger is also made in 25-40 cycle model.

Now you can operate your radio set from the light socket. Merely by adding the new Balkite Combination Radio Power Unit. Once connected to your "A" battery and set and plugged into the light socket, it supplies automatic power to both circuits. You need not even turn it off and on, for it is controlled by the filament switch already on your set and is entirely automatic in operation. It will give you a constant quality of reception that cannot be secured in any other way.

Balkite Combination can be installed in a few minutes, either near the set or in a remote location. Like all Balkite Radio Power

Units it has no tubes, nothing to replace or renew, is a permanent piece of equipment, and is built to conform with the standards of the Underwriters' Laboratories. It is noiseless in operation. It will serve any set now using either 4 or 6-volt "A" batteries and requiring up to 30 milliamperes at 135 volts of "B" current — any set of 8 tubes or less, including power tubes.

Add Balkite Combination to your radio set and know the pleasure and convenience of owning a receiver always ready to operate at full power. Price \$59.50. [\$83 in Canada.] Ask your dealer. Fansteel Products Company, Inc., North Chicago, Illinois.

Listen to the Balkite Radio Symphony Concerts with Walter Damrosch and the New York Symphony Balkite Hour Saturday Nights 9 P. M. Eastern (8 P. M. Central) Standard Time, over WEA, WEEL, WGR, WFI, WCAE, WSAI, WTAM, WWJ, WGN, WCCO, KSD, WDAF, WOC.

FANSTEEL  
**Balkite**  
Radio Power Units



# Why the Parsons always had the Money to do What They Wanted

By WALLACE AMES, *Financial Editor*

"Among the passengers booked to sail January 10 on the Marco Polo for a month's cruise in the West Indies, are Mr. and Mrs. Henry T. Parson."—*News Item*.

"WHY, I can remember," remarked Mrs. Kirk, "when they got married, Bill Parson was just a cub reporter on the Courier. He used to solicit classified advertisements on the side. They boarded and Amy kept up her work as stenographer for over a year. And now they seem to be throwing money around."

"I heard that Parson has been made Managing Editor," replied Mr. Kirk. "Guess they are celebrating his new job by blowing in some of the fancy salary he is now drawing."

"Wonder what that trip costs," mused Mrs. Kirk. "Do you suppose we could go, too?"

"Not this year," grumbled her husband. "We still have three more payments to make on the car."

"What gets me," went on Kirk, in a perplexed, somewhat envious manner, "is how the Parsons can afford to do all these things. I don't know what Bill is making, but I always thought I earned as much, or more, yet they have things we can't afford, and they always seem to be well fixed with cash besides."

KIRK was right—in a way—about the Parsons celebrating Bill's rise in business by taking the West Indian Cruise. But Kirk did not know this: They were paying for the trip, not out of salary, but with bond interest.

Kirk was right about another thing—that he had been earning practically the same income as Parson. The reason the Parsons could "have everything" while the Kirks could not wasn't a difference in the earnings of the two men, but a very great difference in the way they managed their money when they got it.

Kirk's point of view was this:

"What can we get with my salary?" And there were always so many things they wanted. Installment buying made it easy to spend the money before it was earned. Even when salary raises came the extra money hardly helped them to get caught up.

The Parsons started their married life on quite a different financial system. They set down three perfectly simple, but very powerful business rules to govern their family finances. 1. Establish a budget and stick to it. 2.

much easier to have some interest coupons coming due about the same time than to have to "dig up" the money.

Or the automobile. That increases the family expense probably \$25 a month or more. With all due respect to the virtues of the motor car, it is a much more virtuous addition to the family if, when it is purchased, bond interest is ready to help take care of the additional expense.

Home buying. A building and loan association or mortgage company will help you finance it. But you must have some money to put in it. And the more cash you have the more liberal the mortgage terms. Today's bond buying program will supply the funds with which to build tomorrow's home.

THE Parsons had the right idea. They used their *earned* income to buy *investment* income. After a few years they were well able to have the many things that the Kirks never could have because the Kirks used all their money to buy everything but more money.

The Kirks actually thought this all out years ago. But at that time they could conveniently save only \$500 or \$1,000 within a year. That meant only \$30 or \$60 interest—a mere drop in the bucket—so they

thought. That is why they followed the premature spending method. And after several years they are still worrying about debts, still bothering their friends with petty borrowing, still looking with envy at the Parsons.

THE things the Parsons went without several years ago make them no unhappier now. They enjoyed themselves even in the days when they were putting a few drops in the bucket every payday. Before they realized it the drops made a whole pailful.

Here is a New Year's resolution for you: *Quit premature spending and begin special purpose investing.*

## HOW TO GET AHEAD

THIS new Department is to help readers in the establishment of proper financial programs at the beginning of their business careers; it assists those who have accumulated money in the proper investment of it so that it will be safe and so that it will grow.

The Editor of this Department is an authority on investment matters and he will not only every month give the readers interesting and useful information in his articles, but is also ready to aid in personal investment problems. Advice will be gladly given regarding the proper investment of funds and proper plans of saving.

Any advertising appearing in this section will be carefully investigated by the Publisher of POPULAR SCIENCE MONTHLY. Readers can be sure that companies advertising are reliable and that they offer securities which represent sound financial investments. While investments obviously cannot be guaranteed by the Publisher, every effort will be made to insure that only advertisements of absolutely reliable companies are accepted.

Address letters to: Wallace Ames, *Financial Editor* POPULAR SCIENCE MONTHLY, 250 Fourth Ave., N.Y.

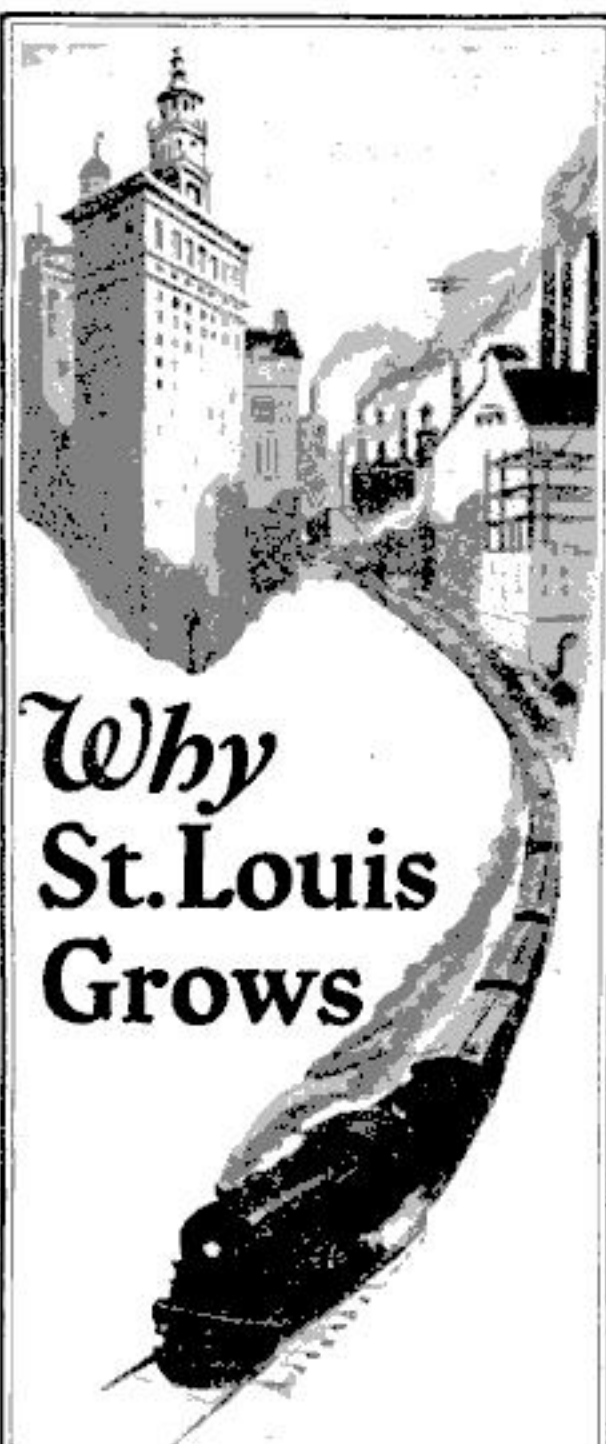
Make saving the first charge in the budget. 3. Postpone luxuries until they can be bought with interest.

Kirk had to earn himself all the money his family spent. Much of the money the Parsons were spending was earned by Bill's investments!

Why not, on January 1, start *Special Purpose Investing*? The principle is as broadly applicable as the needs and desires of man. It works equally well either for periodical expenses or for the indulgences which one hopes to enjoy perhaps once in a lifetime.

Take insurance premiums, income taxes, house repairs and other outlays that come around once a year. How





## Why St. Louis Grows

**T**HERE are adequate "reasons why" for St. Louis' remarkable growth and development. St. Louis has an ideal combination of the chief factors in a successful industrial city and distribution point:

- Central location.
- Nearness to raw materials.
- Fuel, water and power.
- Economical distribution.
- 28 railroads "to everywhere."
- River transportation.
- Satisfactory labor conditions.
- More than 3,500 factories.
- 211 different kinds of industries.

These are some of the reasons why **196 new industries** have come to St. Louis in the last six years. St. Louis manufacturers **Ship From the Center—Not the Rim.** Your factory in St. Louis would have a distinct advantage over competitors not so favorably located.

The complete story is told in our new booklet, "Why St. Louis Grows." Write for it.

Address Dept. 16



**CHAMBER OF COMMERCE**  
ST. LOUIS, U.S.A.

## Financial Booklets Available to Readers

**A**NYONE with money available for investments will find the booklets listed below of help in getting ahead financially. You may obtain any of these booklets by writing direct to the issuing house. It will be appreciated if you will mention **POPULAR SCIENCE MONTHLY** when writing for booklets.

"**HOW TO BUILD AN INDEPENDENT INCOME**" presents a modern way of saving money, explains how first mortgage bonds may be purchased by monthly deposits, and presents tables showing results attainable by carrying out their plan. Address: The F. H. Smith Company, 815 15th St., N. W., Washington, D. C.

"**DIVERSIFICATION AND VIGILANCE**" presents a brief analysis of seven basic principles that assure success in the management of personal investments. Address: A. B. Leach & Co., 57 William Street, New York, N. Y.

"**WHAT YOU SHOULD KNOW ABOUT FIRST MORTGAGE BONDS**" tells about real estate bonds, their safety and how they will increase your income. Address: Adair Realty & Trust Co., Healey Building, Atlanta, Ga.

"**FORTY-FOUR YEARS WITHOUT LOSS TO ANY INVESTOR**" presents the safety record of this house and describes the safeguards constituting the Straus Plan. Address: S. W. Straus & Co. Desk P, Fifth Avenue & 46th Street, New York, N. Y.

"**SAFE BONDS FOR INVESTMENT**" presents their current list of diversified investment offerings, with instructive investment comment. Address: Halsey, Stuart & Co., 201 South La Salle St., Chicago, Ill.

**THE MAKING OF A GOOD INVESTMENT** explains the methods employed by the United States Mortgage Bond Co. in originating first mortgage bond issues which pay 6% with principal and interest guaranteed, or 6½% without the guarantee, which is optional with the investor. Address: United States Mortgage Bond Company, 607 Shelby Street, Detroit, Mich.

**HOW TO GROW AND HARVEST DOLLARS** describes a savings-investment plan offered by that Company, and describes how to accumulate from \$4,603.25 to \$46,032.47 by monthly investments of from \$10 to \$100. Address: H. O. Stone & Co., Stone Building, Chicago, Ill.

**AN INVESTMENT INSURED FOR ITS LIFETIME** describes a plan of insured mortgage investments. Nine points of safety are explained. Address: Mortgage Security Company of America, Camp & Canal Streets, New Orleans, La.

**RULES FOR SAFE INVESTMENTS** explains in language that the layman can understand the important factors of safety of real estate bonds. Address: American Bond & Mortgage Company, 345 Madison Avenue, New York, N. Y.

**BUYING BONDS BY MAIL** explains how the investor may safely and conveniently deal with an investment banker through the mails, and without the usual advantage of direct contact. Address: A. C. Allyn and Company, 67 West Monroe Street, Chicago, Ill.

**YOUR MONEY** covers the points of general interest to the investor who is planning to put his money in sound mortgage bond investments. Address: Fidelity Bond and Mortgage Co., 39 South La Salle St., Chicago, Ill.

**HOW TO ANALYZE A FIRST MORTGAGE REAL ESTATE BOND ISSUE** is the self-descriptive title of a booklet published by the Federal Bond & Mortgage Co., Griswold & Clifford Avenues, Detroit, Mich.

*Now* **54** *years*

## OF PROVEN SAFETY

Send for anniversary booklet and 1927 edition of "How to Build an Independent Income"

**W**ITH the beginning of 1927, The F. H. Smith Company marks the completion of 54 years of continuous service to first mortgage investors—54 years in which every cent of interest and maturing principal has been paid promptly and in full. Founded in January, 1873, The F. H. Smith Company now has a record of

## No Loss to Any Investor in 54 Years

Our anniversary booklet, "Fifty-four Years of Proven Safety," shows you how this record has been maintained, and how it has created world-wide confidence in Smith Bonds. It explains how every Smith Bond is secured by a first mortgage on modern, income-producing city property. It tells you why men and women in 48 States and in 33 countries and territories abroad have bought Smith Bonds by mail.

For 1927—adopt this plan to invest your monthly savings at **6½%**

The 1927 edition of our booklet, "How to Build an Independent Income," tells how you can buy one or more \$100, \$500 or \$1,000 Smith Bonds by ten equal monthly payments, and how your regular monthly payments earn the full rate of bond interest—6½%. It shows the results you can accomplish by investing \$10, \$20, \$30, \$40, \$50 or more a month at 6½%.

For example, the booklet shows how an investment of \$20 a month, at 6½%, with the interest reinvested at the same rate, grows in 10 years to \$3,370.43; in 20 years to \$9,760.20; in 30 years to \$21,639.46; in 40 years to \$44,395.30. It shows how your money is multiplied over and over again by systematic investment and reinvestment at 6½% interest.

For copies of our two booklets, send your name and address on the form below.

**The F. H. SMITH Co.**

Founded 1873

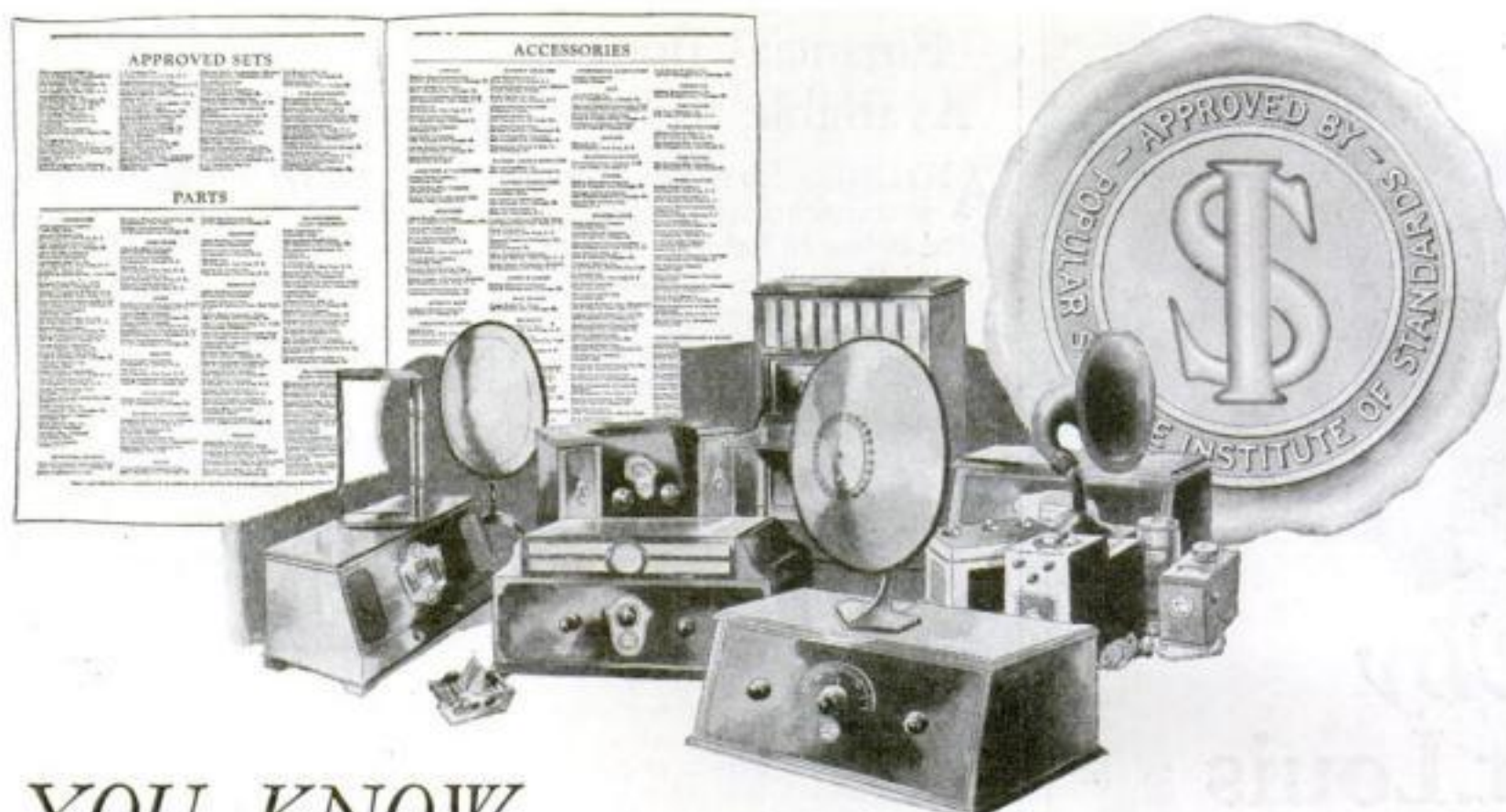
SMITH BUILDING · WASHINGTON, D.C.

NEW YORK PITTSBURGH BOSTON PHILADELPHIA  
BUFFALO ALBANY MINNEAPOLIS

Name .....

Address .....





## DO YOU KNOW WHAT RADIO TO BUY?

AT THIS season of long winter evenings and Christmas present buying, radio figures prominently in the minds of a lot of people. But, in solving these three problems, it offers a knotty problem all of its own—that is, *what radio apparatus to buy?*

The man who is buying radio equipment these days is exercising a great deal more care than was customary in the first years of radio. There are three perfectly sound reasons for this.

In the first place, he has learned the importance of keeping away from the inferior equipment on the market. Second, he is much more exacting than he was in those early days of radio. And, in the third place, whether he is buying his first set or replacing it, he is usually investing considerably more in a radio receiving outfit than seemed advisable when radio had not become the stable industry it is today.

Buying a \$50 or a \$500 radio outfit becomes an all-serious problem to such a man. But what would he do if confronted with the problem of buying \$50,000 worth of radio equipment a month? He might do the same thing a million-dollar exporting concern did—secure a list of the equipment approved by the Popular Science Institute of Standards and make selections from it.

"We have found it to be good business to buy only radio apparatus that has passed the official tests of the Popular Science Institute. In July, this year, we bought \$50,000 worth of radio

merchandise from your list of approved radio products. Since adopting this policy, we have never had a single complaint from a customer."

This is the statement of Mr. Arthur F. Street, President of R. W. Cameron & Co., Inc., of New York and Australasia. This big exporting firm, rated by Bradstreet's at "a million dollars high," is the American representative of leading radio retailers in all parts of Australasia. It sells American merchandise through branches in Sydney, Melbourne, Brisbane, and Wellington, New Zealand. Behind the firm stands a seventy-four-year record of success.

Not many readers of POPULAR SCIENCE MONTHLY face the buying problem of R. W. Cameron & Co., Inc. Few have

to figure on a 12,000-mile separation from the manufacturer—an important consideration should any equipment prove defective. But the care which this great exporting concern exercises in selecting its radio equipment can well be followed by every radio purchaser. Purchasing 100 percent approved equipment leads to 100 percent satisfaction has been the experience of the thousands who have been guided by the test findings of the Popular Science Institute of Standards.

MORE and more people are taking advantage of the Institute's guidance and help in solving radio buying problems. They hesitate to accept the often biased opinion of a radio dealer, or base their purchases on the somewhat limited experience of friends.

They feel that, in coming to the Popular Science Institute for advice, they are getting the benefit of an extensive and impartial knowledge of radio equipment as a result of laboratory tests made on such products. This is well expressed by a New Jersey reader in a letter received today—

"I am a firm believer in your Institute and feel safe in purchasing approved merchandise; while on the other hand, I would not even consider a set if approval had been withheld or withdrawn."

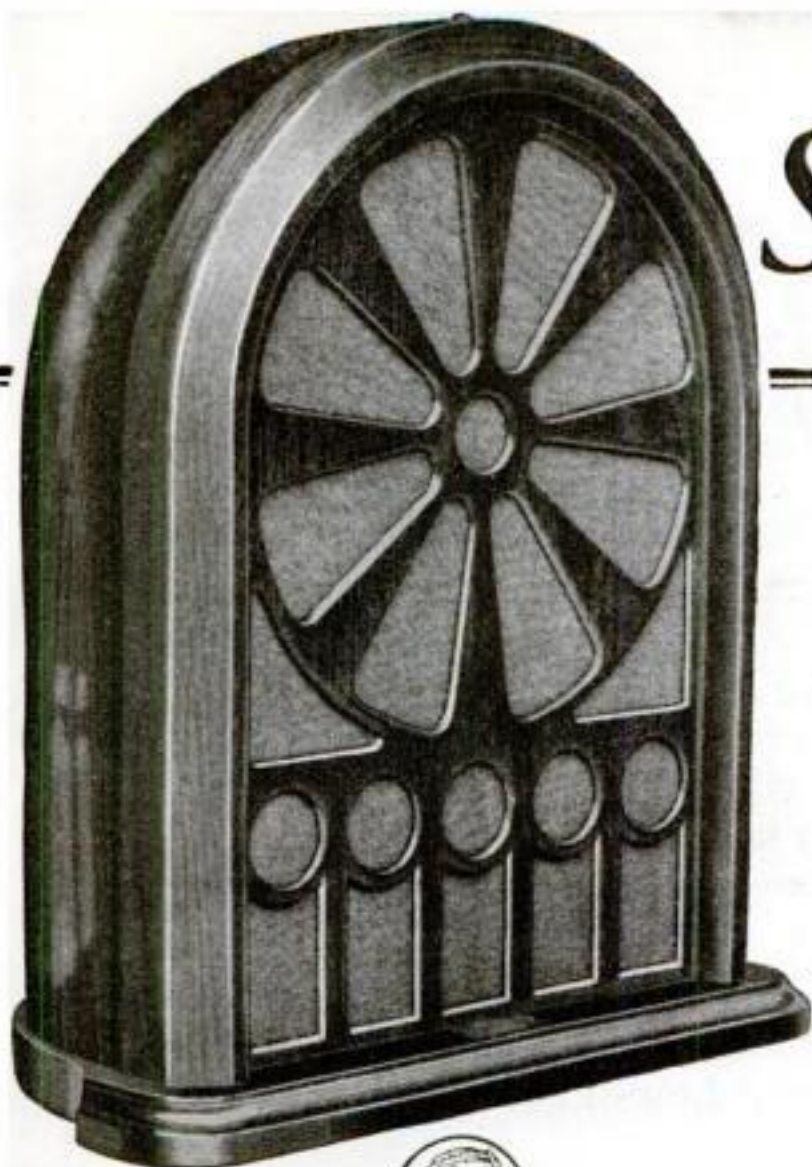
Readers who are interested in learning what radio equipment (also tools) have the approval of the Institute can secure a list of approved products. Address Popular Science Institute, 250 Fourth Avenue, New York, N. Y.

### Popular Science Monthly GUARANTEE

The above seal on an advertisement indicates that the products referred to have been approved after test by the Popular Science Institute of Standards.

POPULAR SCIENCE MONTHLY guarantees every article of merchandise advertised in its columns. Readers who buy products advertised in POPULAR SCIENCE MONTHLY may expect them to give absolute satisfaction under normal and proper use. Our readers in buying these products are guaranteed this satisfaction by POPULAR SCIENCE MONTHLY. THE PUBLISHERS





# IT Sounds Right!

ALL the tones perfectly—that is the result you want for complete enjoyment of your radio. You secure that result with the All-American Reproducer—pure, *natural* tone of voice or instrument; with clearness of highest treble and mellow richness of lowest bass; in perfect uniformity, at full volume or at a whisper.

You get “the best” out of your receiver with this fine instrument. It combines the best features of the two leading principles of reproduction—cone-type and sounding chamber; which explains its accuracy in preserving the naturalness of all tones at any volume.

  
**ALL-AMERICAN**  
TRADE MARK  
**Reproducer**

Price \$25.00 Slightly Higher West of the Rockies

## Socket Power you can depend on

Operate your set from the handiest light socket with All-American “Constant-B” Battery Eliminator.

With the All-American “B” Eliminator you get socket power from a unit that is tested and proved; recognized as a dependable instrument that can't go wrong.

It is made to meet any voltage requirements; five output taps provide steady uniform plate current; two variable controls permit exact regulation of voltages for R. F. and detector stages. A “High-Low” switch assures proper output for all receivers up to ten tubes.

“Constant-B” is compact, attractive; no acid, no hum. Built complete with Raytheon Tube.



  
**ALL-AMERICAN**  
TRADE MARK  
**Battery Eliminator**

Price \$37.50 Slightly Higher West of the Rockies



## New 1927 Radio Key Book

You'll enjoy reading it—48 pages of interesting, up-to-the-minute facts about radio, simply told. Also full construction details of all leading types of circuits. Send 10 cents (coin or stamps) to cover postage and mailing cost.

**ALL-AMERICAN RADIO CORPORATION**

4205 Belmont Avenue, Chicago, Illinois

OWNING AND OPERATING STATION WENR 266 METERS



# Quality Always Pays

**B**UYING a radio receiver is investing in pleasure, entertainment, information. You get what you pay for. If you want true radio happiness that will endure, then you'll choose a Synchrophase.

For Synchrophase reception is unusually superior because of several Grebe developments: *Colortone, Binocular Coils, S-L-F Condensers, Low-Wave Extension Circuits, etc.*

If you want to know *why* they combine to produce such reception as, perhaps, you've never realized was possible,

*Write for Booklet P*

A. H. Grebe & Co., Inc., 109 West 57th St., New York

Factory: Richmond Hill, N. Y.

Western Branch: 443 So. San Pedro St., Los Angeles, Cal.

The **GREBE** <sup>®</sup>  
**SYNCHROPHASE**

TRADE MARK REG. U.S. PAT. OFF.



TRADE MARK  
REG. U.S. PAT. OFF.

All Grebe apparatus is covered by patents granted and pending.



"Good words gain you honor in the market place; but good deeds gain you friends among men."

It is performance that gains the Synchrophase praise and friendship from its owner.

*Deeter Miller*



The Grebe Synchrophase is supplied in the standard cabinet model, with and without battery base, and in five beautiful console models.

This Company owns and operates stations WAHG and WBOQ; also low-wave rebroadcasting stations, Mobile WGMU and Marine WRMU.





# POPULAR SCIENCE MONTHLY

SUMNER N. BLOSSOM, Editor

January, 1927



Sir Alan Cobham, whose exploits rival in stirring romance any tale of a knight of old, from a drawing by S. J. Woolf for the *New York Times*

## *The World's Greatest* **SKY** *Taxi*man

*A Story of Sir Alan Cobham,  
Who Rides Roaring Winged  
Steeds to Glorious Adventure*

By ROBERT E. MARTIN

**A**S THIS is written there comes to America a knight who, in fearless conquest and romantic adventure, can match the exploits of any hero who graced the Round Table of King Arthur of old. For coat of mail he has sheathed himself in the helmet and goggles of an aviator. For steaming charger, he rides a roaring winged steed which has carried him to the ends of the earth. For his quest, he seeks not to rescue fair maiden from enchanted castle but to bridge the skies above the world, to chart new paths in the air. For enemies he has braved the bullets of savage tribes, the sky-blown sands of the desert, the rocky walls of mountain peaks, and the tempests of the sea. He has even met with gigantic dragons! For pure adventure he once risked his life to peer with glistening eyes into a volcano's smoking crater. In all, the length of his travels, added together, would reach more than halfway to the moon!

The name of this hero of modern romance is Sir Alan Cobham, recently knighted by King George of England for his latest and greatest exploit, a 28,000-mile air journey from London to Australia and back again. In this and two previous journeys, one to India and back, another to South Africa and back, he traveled some 60,000 miles—enough to circle the earth twice.

Only seven years ago, Sir Alan was an unknown and all but penniless young "gypsy flier"; a war veteran, living a hand-to-mouth existence, picking up

"fares" wherever he could find them. Today he is a Knight Commander of the British Empire, hailed as one of the greatest commercial aviators the world has yet seen; honored by kings, dictators, princes and presidents.

Back in 1919, when Great Britain's war-time air forces were demobilized, young Cobham found himself, with 20,000-odd other pilots, walking the streets for a job. A handful of civilian air jobs were to be filled, but none of these was for him. In London he was a stranger.

What Cobham did at that crucial moment was a direct portent of the triumphs of Melbourne and London seven years later. He was not one of the 20,000 who returned from cockpit to office desk with sighs of relief for the regained security. His head may have been in the clouds, as friends told him; but he replied that he felt more at home there!

**H**E BECAME a chauffeur of the air, a sky taxi driver.

With such small funds as he had left, added to what he could borrow, Cobham bought a secondhand government machine, patched it up, and went to work. Among his first fares were American tourists. He taxied them to Paris, Berlin, Venice and Constantinople; or drove them on short hops to Wales and Scotland.

Two years passed, during which Cobham became known as England's "air

taxi

man." Then followed the first of a series of romantic exploits. A wealthy American engaged him as chauffeur for a ten-thousand-mile aerial joy ride over the countries of Europe. This new patron was Lucian Sharpe, an adventure-loving tool manufacturer of Providence, R. I.

On a flying field at Naples some weeks later, the two men were standing beside Cobham's plane when Sharpe, pointing toward grim Vesuvius smoking menacingly in the distance, exclaimed: "Cobham, let's fly over the crater!"

**T**HE pilot glanced sharply at his employer.

"Do you really mean that? All right, let's go!"

He climbed into the cockpit. Sharpe scrambled in beside him. Soon they were soaring over the city toward the giant smokestack. The American could not have guessed that in the heart of the young pilot there had also lurked a desire to peer into the boiling pit; nor could he have been prepared for the thrill that followed.

No sooner had the plane crossed the rim of the crater than a whirling breath of poisonous gas caught it and with terrific force shot it like a feather a thousand feet in the air.

Choking and dizzy from the fumes, Cobham at first was helpless to control its crazy flight. Then, guided by instinct,



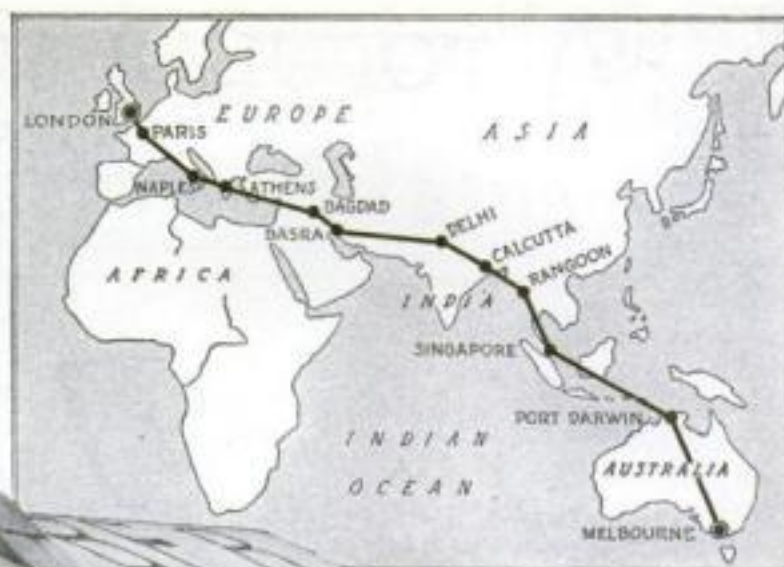


### Thrills That Come to Few

Triumphs reserved for the world's greatest heroes have come to the ex-gipsy flier. Above: Cobham in his plane over Melbourne harbor at the end of his Australian flight. Right: Acclaimed by London after charting a new air trail to Cape Town, Africa

### Hopping a Hemisphere

The earth has become a survey map to Cobham, folding and unfolding under his eager eyes. Right, route of his latest, greatest flight, from England to Australia



he managed to bring the ship to an even keel just in time to save himself and his passenger from frightful death.

ONCE, while carrying a British general on a 1600-mile flight across Europe to Constantinople, Cobham was enveloped in a blanket of low-hanging clouds in the Alps. Forced down to a height of fifty feet above the Danube river, he wound his way for a hundred miles through the narrow passage between the sheer, jagged cliffs of the famous Iron Gate, which towered a thousand feet on either side. Below them boiled rapids and cataracts. One false move, a single instant of indecision or misjudgment, would have crushed them against the rocky walls.

"We didn't have room to turn around," he said later of this close shave. "It was a bit uncomfortable for a time, but we carried on and finally got out."

In these and many other exploits, the young pilot was inspired not so much by love of adventure and personal gain—although flying for hire was his daily bread—as by the hope of achieving a great ambition. That goal was to prove to the world that the airplane could be employed as safely and economically as a railway train or motor car for travel. His ambition was partly realized in the Constantinople trip mentioned above; for when he and his passenger reached Constantinople (in October, 1922) they had covered 1600 miles over some of the most treacherous country in Europe at an average height of less than 100 feet, and without a serious mishap. In shorter flights, likewise, he was able to demonstrate that an airplane could be relied upon to meet emergencies and every demand for speed.

Whenever news photographs needed to be rushed from European cities and from outlying points in the British Isles to meet editions of London newspapers, Cobham was the man who did it. When an American missed his New York steamer at Southampton, Cobham flew him to Cherbourg to catch it. When Steve

Donoghue, the famous English jockey, was in a hurry to get to France to ride in the Deauville races, it was Cobham who picked him up and flew him there.

These, however, were more or less minor achievements. The big opportunities to prove the worth of commercial flying were still to come. In the summer of 1924, Cobham won the King's Cup race over the 950-mile course around Great Britain, defeating nine other planes and completing the course in a little more than nine hours. That same year he was awarded the Britannia Trophy for the greatest achievement of a British aviator during the year—a 12,000-mile flight to the Near East and return, which took him across Africa, Spain and France.

THEN, in the spring of the following year, he completed the first of the three daring long-distance exploits which eventually lifted him to the rank of knighthood. This was a flight from England to Rangoon, in Burmese India, and return—a total distance of 17,000 miles—carrying as passenger Gen. Sir Sefton Branker, Director of Civil Aviation in the Air Ministry. His course took him over northern Europe to Constantinople, then to Bagdad, Delhi and Calcutta and across India.

It was in India, during this tour, that Cobham set out on a spectacular attempt to achieve what no man on earth has ever done—reach the top of Mount Everest, the world's highest peak. He had arrived at Calcutta with his passenger when the idea occurred to him.

"General," said Cobham to his companion, "I'd like to have a good look at the Himalayas from the air. Perhaps I can't get over the top of the big one, but I'm going to try."

So, leaving Sir Sefton in Calcutta, he and his mechanic ventured forth. While the attempt failed, the flight had one worth while result. What happened is best described in Cobham's own words.

"I reached an altitude of 17,000 feet," he said, "and was prevented by clouds from rising any farther. But our attempt

was not in vain. Until the clouds started we had the loveliest view one could imagine. We could see clearly for two hundred miles. The flight proved the feasibility of making a complete aerial photographic survey of the Himalayas."

The success of the India trip, for which he was again awarded the Britannia trophy, led Cobham, in November of the same year (1925), to embark on another trail-blazing air voyage—this time from England to Cape Town, at the southern tip of Africa, and return—16,000 miles in all. Although a thousand miles shorter than the previous jaunt, this trip presented far greater perils. Much of the 8,000-mile path was above lands never flown over before—f forbidding mountain ranges and dense jungles inhabited by unknown tribes. Most dangerous of all were the terrific heat and the dust storms of tropical Egypt. Anywhere along this route a forced landing might mean the cruellest form of death. Yet, when he set out in his powerful De Havilland biplane, Cobham carried only a couple of suitcases for baggage, as if going on a week's pleasure jaunt.

As he sped on, the fury of tropical storms beat against him and drove him from his course. For 2,000 miles steaming jungles made the air so hot that even 5,000 feet up the heat was almost unbearable. Once he had to climb to 7,000 feet to find a temperature as low as ninety degrees in the shade. Once, sandstorms drove him to a height of 15,000 feet. But, in the end, a sky trail to South Africa was marked on the map.

RETURNING to England in March of last year, Cobham had barely rested from this journey, when, in June, he embarked with his veteran mechanic, A. G. Elliott, on the latest and greatest of all his adventures—the 28,000-mile journey to Australia and back, girdling the Eastern Hemisphere.

All England—in fact, most of the world—watched the progress of that amazing flight with tense interest. First Paris was passed, then Naples and Athens. Now the



fliers, bridging the Mediterranean, headed across the Arabian desert on the road to Basra, at the head of the Persian Gulf. Then came the shock of tragedy. Elliott, the mechanic, was slain, the victim of a wandering Arab's rifle!

It was a tragedy so amazing and unexpected that at first the English, back home, could hardly believe the news when they read it.

**C**OBHAM and Elliott were flying low over the desert, approaching Basra. Below them dwelt roving Arab tribes, notorious for their lawlessness. Desert winds flung up clouds of blinding sand. Suddenly Cobham was startled by a sharp report. He glanced quickly at Elliott. The face of his comrade was deathly white and distorted with agony; he pressed a hand against his breast. What could have happened? Had a bursting gas pipe inflicted the wound? Whatever the cause, Cobham saw there was no time to lose. He opened wide the throttle of his powerful motor and sped toward Basra. There he glided down to the river Shat-el-Arab. Swiftly lifting the mortally wounded man in his arms, he waded to shore, and from there rushed him to a hospital.

A bullet in Elliott's chest and a bullet hole through the fuselage of the plane told what had happened. Some wandering Arab, either through enmity or as a foolhardy prank, had fired a single shot at the plane from below, and by one chance in a thousand the bullet had struck home!

His eyes wet with tears, Cobham buried his friend at Basra. "It is a foul and cruel blow," he wired home, "probably done by some irresponsible fool who could not do it again if he tried a thousand times." He waited for the arrival of another mechanic, then took up the trail once more. Delhi, Calcutta, Rangoon, Singapore—all were left behind, and at last, with pontoons attached to his ship, he flew out over the islands of the Dutch East Indies.

Again he plunged into adventure so strange and romantic that it might have come straight out of some ancient legend.

**O**N THE little island of Komodo he saw three live dragons—gigantic lizards which, from all appearances, were direct descendants of the prehistoric monsters of mythology. They were ten to twenty feet long, and armed with great claws which enabled them to kill and devour animals as large as horses.

They used their powerful tails as lashing weapons, one blow from which could break a man. In movements they were exceedingly swift. From natives, who lived in mortal terror of the monsters, Cobham learned that the creatures had been known to run down and kill half-wild island ponies, and that they had been seen fighting one another over the carcasses of wild boars.

Two of the dragons, the only ones in captivity, were brought recently to America. One of them died soon after its arrival. Scientists say their dis-

covery and capture constitute one of the most important additions ever made to zoological collections. Rarest of all reptiles, their ancestry dates back 4,000 years, to the time of the pyramids.

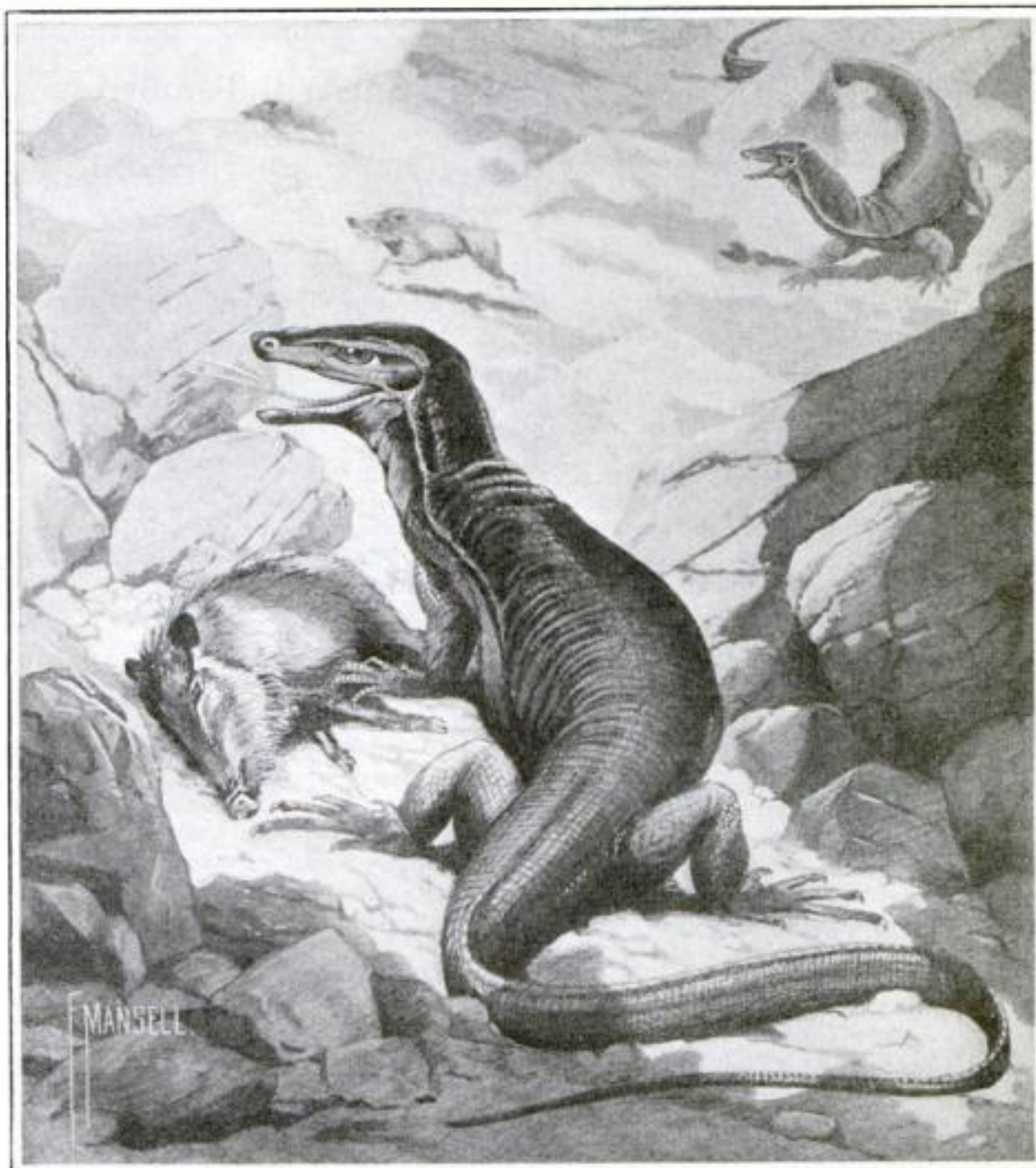
Proceeding to Port Darwin, on the northern coast of Australia, Cobham turned his plane southward and flew overland to Melbourne, his destination, where he arrived early in August. There he was greeted with a tremendous welcome. His journey had taken a little more than a month.

The return voyage proved no less exciting. On the way from the island of Penang, off the Malay Peninsula, to Rangoon, Cobham and his plane mysteriously disappeared. For three days the world waited anxiously, fearing disaster. Then, while rescue parties were being organized, there came a message from the pilot that he was safe. He had been trapped, he said, by the most terrific deluge of rain he had ever known. He described the experience:

**"O**N FRIDAY morning we took off at six o'clock with a bad storm coming up behind, but we hoped to get ahead into fine weather before it arrived, and to reach Rangoon, 600 miles away. But after going forty miles we ran into the worst rainstorms I had ever experienced. They simply blanked out all visibility,

so we turned back. To my dismay, I found bad weather had closed in behind us, so we had to fight our way through the deluge. Often it was impossible to go ahead. But at last we reached Victoria Point again, where we landed and moored up just in time before an even greater deluge came down. It almost swamped the boat that came out to assist us. We moored up in a waterspout, and then jumped into a small rowboat and headed toward shore, 150 yards off. We had pulled only a few yards when the seaplane was obliterated from view by a tremendous downpour."

**A**FTER waiting for a break in the weather, Cobham continued the long voyage homeward. In London on the first day of October, just a month from the time he left Australia, and three months after his departure from England, a vast crowd awaited his arrival. As his ship appeared over the rooftops, then glided down to the waters of the Thames, he was met by a thundering roar of welcome. The crowds, mad with enthusiasm, broke through police lines and overwhelmed him. A few days later he knelt before the King and received the honors of knighthood. He had completed the 28,000-mile air route in 320 hours of flight, at an average speed of 87½ miles an hour.



**One Lash of Its Tail Will Kill a Man**

The days of romance are not past in a world that still holds gigantic dragons for its young heroes to slay. Above is a type of monster Cobham met with on the island of Komodo



# Atomic Bullets Open Magic New



## The Man Who Did It

Dr. W. D. Coolidge, assistant director of the research laboratories of the General Electric Company. With his new cathode ray tube, pictured here, he summons from the invisible universe of atoms magical streams of power that hold untold possibilities



*Mysterious Cathode Rays Make Rocks Glow, Turn Gas to Yellow Powder, and Kill Germs and Insects*



## A Spectacular Bombardment

Remarkable effects of the rays on a crystal of calcite. Bluish-white sparks, believed to be electrical explosions, appear beneath the surface. The crystal glows with cold, orange light long after removal from the path of the rays. Center: The Coolidge cathode ray tube

ONCE again an Aladdin of science rubs his magic lamp and holds the world in wonder. This time he is Dr. William David Coolidge, already famous for his invention of the modern high-powered and portable X-ray tubes, and now the creator of an amazing new instrument that may rank with the discovery of the X-ray in its importance to mankind—a new tube for the production and use of powerful cathode rays.

With the throw of a switch he summons from the invisible world a mighty stream of mysterious energy which transforms, magically, every object which it touches and brings into being new forms and substances never before seen by man. At his word a pure crystal glows with cold light and flashes bluish sparks; the gray face of granite turns brilliant with many colors; colorless gas changes into yellow powder; liquids change into solids; metal takes on a coat of "paint" applied by unseen hands; insects and germs perish instantly.

A slight man, sensitive-faced and sensitive-fingered, wearing big, light-rimmed spectacles, Dr. Coolidge revealed some of these wonders a few weeks ago during the first public demonstration of his new tube before a group of scientists gathered at the Franklin Institute in Philadelphia to honor him for his previous achievements. In the darkened room rested the strange apparatus—a glass tube about a yard long, bulging like a toy balloon at the center, and supported in a maze of wires, coils and insulation. An electric switch was touched. Instantly, with a crackling hum, a ball of purple light, two feet in diameter, hung in the air at one end of the tube. And in this

## What Will Tomorrow Show?

AS IT stands now, Dr. Coolidge's cathode ray tube, described on these pages, is nothing more nor less than a marvelous instrument of scientific research.

But what of tomorrow?

It has been the history of virtually every great development in the realm of pure science that no sooner is it completed than it passes immediately into the field of practical usefulness. That such will be the case with Dr. Coolidge's latest creation, there can be little question.

Here is a mysterious stream of energy that performs miracles never before seen. Scientists observe in wonder. They cannot venture to prophesy. They only know that within the grasp of man has been placed a tool of untold power. And they are confident it will not be wasted.

uneearthly glow the magic was performed.

A clear crystal of calcite, or feldspar, placed in the path of the rays, shone with orange light. Removed, it continued to glow for hours, as if red-hot; yet those who touched it found it stone cold! A tube of colorless acetylene gas, bathed by the rays, instantly changed into a yellowish powder—a new substance entirely unknown to science. It refused to melt even under the terrific heat of 4,000 degrees, and it withstood every attempt to dissolve it with chemicals.

An aluminum disk contained in a tube filled with the same gas became coated with a hard, varnishlike film of brown which the most powerful chemicals could not remove. Castor oil turned into a solid substance. Potassium chloride,

which ordinarily is white, turned purple. A disk of wax, exposed to the rays for an instant, became charged with electricity, much as a fountain pen becomes charged when you rub it with a cloth. The charge remained permanently.

This seemingly miraculous force that can thus change the form and appearance of common substances of the earth—what is it? Scientists have been acquainted with cathode rays for nearly half a century. Never before, however, have the rays been available to experimenters in any but small and weak quantities. Their production has been confined largely to the inside of a vacuum tube; for that reason the extent of their power and their useful possibilities have remained, for the most part, an alluring and tantalizing secret.

THE importance of Dr. Coolidge's achievement lies in the fact that he has succeeded, at last, in bringing the rays out into the open air with greater intensity than ever before, and putting them to work. In so doing he has opened new opportunities for understanding and tapping the atom's hidden power that may lead to untold value.

No one, not even Dr. Coolidge himself, can tell today how far the invention may take us, or what new things it may give to the world. All we can say is that he has brought forth a rich stream of energy, with power to perform unheard-of things.

Cathode rays are the same kind of rays



# Worlds to Us

By HYATT E. GIBSON

as the so-called beta rays which constitute one of the three important emanations from the element radium. The difference between them is that whereas beta rays are produced by nature, the cathode rays are produced by man with the aid of high-voltage electric current.

**BOTH** cathode and beta rays consist of minute negative charges of electricity, or electrons, moving with incredible speed. The velocity of the beta rays is approximately that of light, or about 186,000 miles a second, while that of the cathode rays produced by Dr. Coolidge with an electrical charge of 350,000 volts is about 150,000 miles a second.

Radium, you will recall, is constantly disintegrating; that is, the atoms of which it is composed are constantly breaking down. Every atom of matter, according to the accepted theory, is a tiny solar system, infinitely small, made up of a central nucleus and electrons which swing in orbits about the nucleus like planets about a sun. The nucleus is positively charged, while the electrons are negative charges.

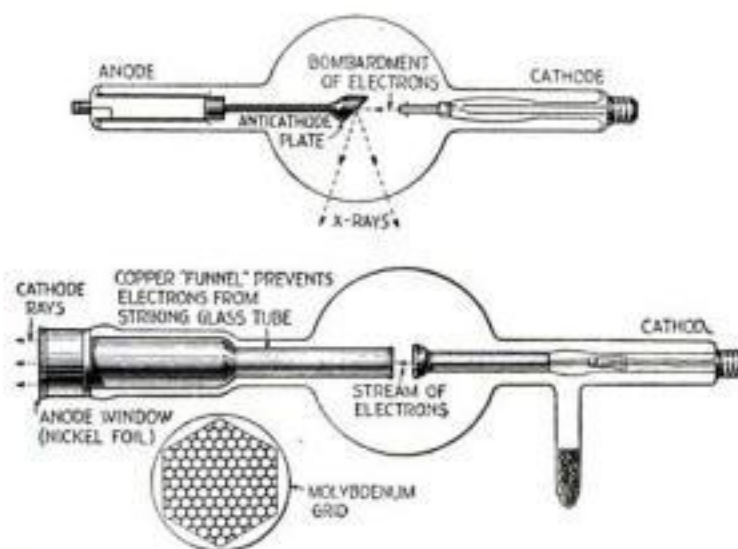
In most elements of matter these opposing charges are so arranged and so nicely balanced as to preserve the atom as an intact unit and keep it from flying apart. It is a characteristic of radium atoms, however, that this balance is easily upset by outside influences, such as sunlight. Its electrons are constantly being driven out of their regular course, and they fly off into the air.

These streams of wayward electrons are the beta rays. The disturbance they produce results in a second form of rays, called the gamma rays, which are really light waves of extremely short length and tremendous penetrating power. These gamma rays, because of their powers of penetration, are the ones that give radium its value for the treatment of diseased tissues.

The X-rays, which have proved of such tremendous value to men, correspond to the gamma rays of radium. Cathode rays correspond to the beta rays of radium. X-rays and cathode rays both are produced in vacuum tubes which are very similar in design.

The source of each is a heated tungsten filament much like the filaments of your radio tubes, which is continually releasing electrons. This filament serves as one of two metal electrodes contained within the tube. The rays, in each case, are produced by passing a high-voltage electric current between the filament, or negative electrode, and the positive electrode, called the anode.

In the X-ray tube the anode is a tungsten plate or shield. When the electrons are hurled against this shield they are reflected through the glass walls of the tube in the form of the extremely short

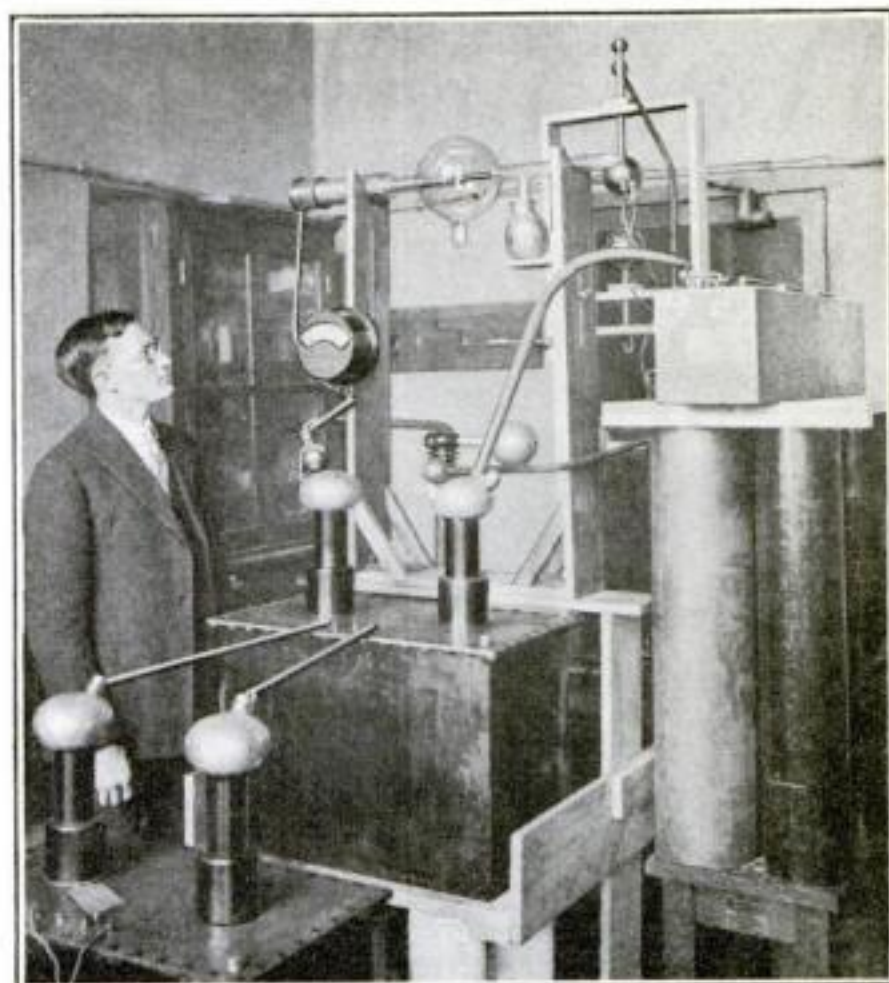


## The X-Ray and the Cathode Ray

In the X-ray tube (upper diagram), electrons from a heated cathode filament are hurled against a tungsten plate at the center of the tube. The bombardment is reflected through the glass tube in the form of extremely short light waves, known as X-rays. In the cathode ray tube, the stream of electrons passes, unobstructed, through a copper tube and out into the air through a nickel window.

and penetrating light waves. In the new cathode ray tube, on the other hand, the anode is in the form of a "window" at the opposite end of the tube, and through this window the stream of electrons is allowed to pass out into the air at terrific speed.

The cathode rays derive their name from the fact that they are discharged from the cathode, or negative electrode. In the earliest experiments they were produced only in the walls of the tube. About thirty years ago, however, a Ger-



The Cathode Ray Apparatus

An electric current of 350,000 volts, sent through the glass tube at the top, shoots electrons into the air at a speed of 150,000 miles a second

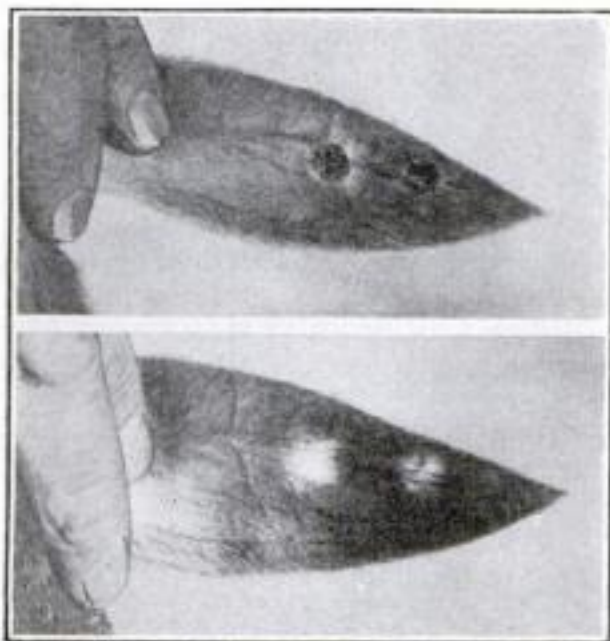
man scientist, P. E. A. Lenard, succeeded in getting small quantities of cathode rays outside the tube through a thin aluminum window. What the Coolidge tube now achieves is to shoot terrific bombardments of electrons out of the tube, like bullets out of a machine gun, and to toss them into space in great quantities and at tremendous velocity.

In fact, Dr. Coolidge estimates that his tube throws off as many electrons each second as would emanate from a ton of radium, which, if it could be obtained, would be worth at least a hundred billion dollars! Since there is only about a pound of radium in existence, this means that the tube will produce two thousand times as many electrons as all the available radium in the world!

**TO PROVIDE** an exit for the electron bullets, the Coolidge tube employs a window consisting of a circular film of nickel only five ten-thousandths of an inch thick and three inches in diameter. This window is braced by a grid of molybdenum, a very strong metal, to withstand the air pressure from without.

The manner in which the electron bullets travel through the tube is in itself amazing. From the heated filament the electrons are released at comparatively low speed—about a mile or two a second. But the instant that the high-voltage current—350,000 volts—is applied, they are literally electrified into action. Within the space of an inch, they increase their speed to 150,000 miles a second or more. Maintaining this speed, they shoot across the tube, guided by a copper shield that keeps them from plunging through the glass bulb, and leap through the nickel window.

But how, you may (Continued on page 128)



Turned on a rabbit's ear, the cathode rays caused small round scabs (above) which fell off. Two weeks later a thick new growth of snow-white hair (below) replaced the original gray hair



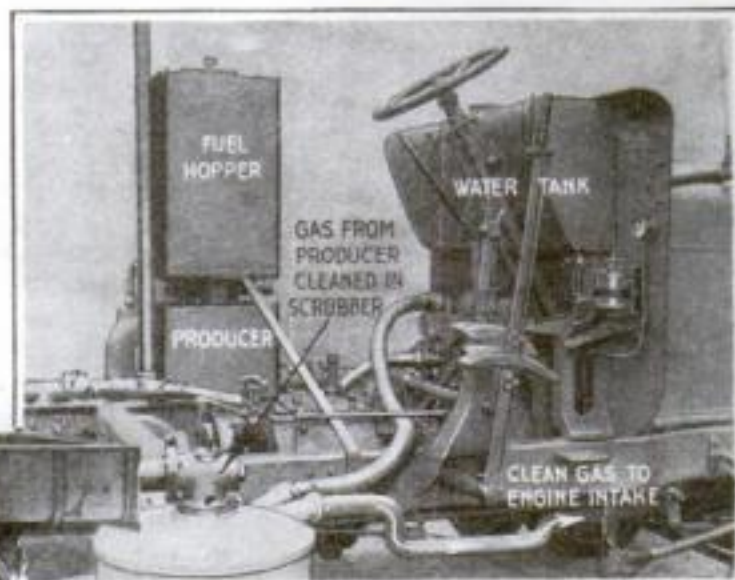
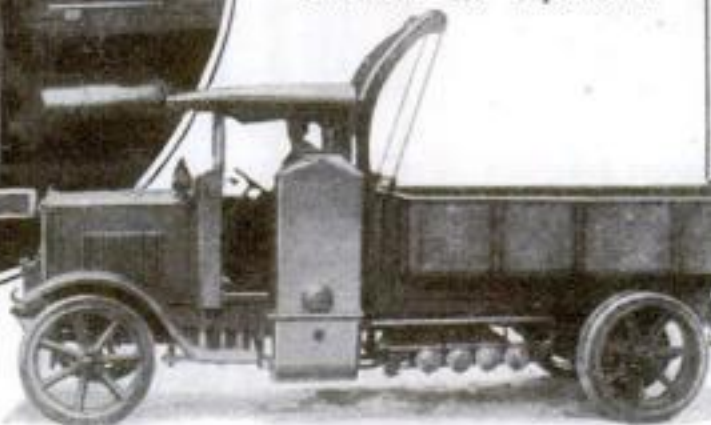
# Water or Dust May Run Our Cars

*Wood, Coal, and Corn Are Other New and Strange Gasoline Substitutes*

Right: The British truck that runs on "producer" gas, formed by blowing steam over a bed of burning coal, corn, or any other material rich in carbon. Below: The French wood-burning truck purchased by the U. S. Bureau of Standards for experiments



The furnace or "gasoline" of the wood-burning truck, located beside the driver's seat, burns wood or coal to generate inflammable gas for fuel in place of gasoline



By JOHN E. LODGE

**A**N AUTOMOBILE that burns wood instead of gasoline, one of the strange type recently designed by the French inventor Imbert, has just been purchased by the U. S. Bureau of Standards in Washington, D. C. This remarkable car, which runs on the coal-gas produced in its own wood- or coal-burning furnace, represents one of many attempts that engineers and chemists are making to provide new motor fuels against a predicted future shortage of gasoline.

Already French scientists have produced an electric car that runs more than 900 miles without recharging; but though electric and steam power may remain to fall back on in case of need, many scientists declare this will not be necessary, and that natural or synthetic fuels will make man independent of the gasoline supply. Wood, coal, vegetable oils, ether, and even corn, water, molasses, and grain dust are possible sources for substitute automobile fuels.

**SCIENCE**, in attacking the problem, is following three separate lines of research. First, to produce directly an inflammable gas to be mixed with air and exploded in the cylinders. Second, to manufacture a cheap liquid fuel that, like gasoline, can be gasified to form with air an explosive mixture. Third, to use a fine, inflammable, solid dust suspended in air to form an explosive mixture.

Inflammable gas as a fuel for internal combustion engines is not new. Stationary motors have been run on gas. In fact, during the war, when gasoline had to be conserved for airplane use, London omnibuses were run on illuminating gas, carried in huge rubber bags on the tops of the vehicles. Only lately has it been thought feasible for a moving automobile to carry its own coal-gas generating plant. One of the new wood-burning cars, carrying fourteen persons, not long ago took

its passengers for a 3200 mile tour of France at a fuel cost of \$14.50, against \$120 for the same mileage on gasoline.

Blue water gas, a form of "producer gas" made by blowing steam over the incandescent bed of a coal fire, also has been tried. Interesting experiments have been made by a British manufacturer with a truck burning coal, charcoal, corn, or, in fact, any material rich in carbon. Chemists tell us that this blue water gas consists of a mixture of hydrogen and the inflammable and poisonous gas, carbon monoxide. Coal gas is mostly hydrogen.

Now another French scientist, Prof. Charles Henry, announces that he has made hydrogen for fuel from water vapor with the aid of a secret catalyst—one of those strange chemicals that make a reaction take place without itself taking part in it or being used up. The temperature he uses is that of the gas range or coal furnace in your home. It is pos-

sible that this process will make it practicable for you to stop your car at the filling station of the future and call for "five gallons of water" instead of gas.

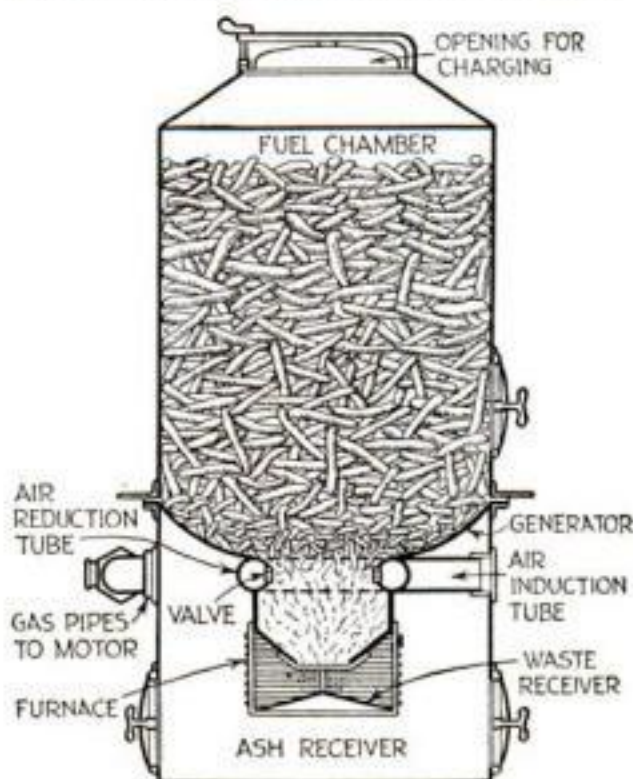
But even if all these discoveries should come to naught, scientists have liquid fuels to fall back on. Alcohol-burning engines have been made. While alcohol from wood is at present expensive, other sources may reduce its price. Methanol, a recently developed German fuel substitute, is a "wood alcohol" produced from coal and water. In France, ethyl alcohol, the potable variety, has been synthesized for fuel. Molasses is another possible source. A Russian, M. Makhonine, reports a fuel from electrically heated vegetable oil.

Use of ether as a motor fuel has been advocated. This compound has the advantage of not carbonizing the cylinders. All of its combustion products are gases, blown away through the exhaust.

Dust has been tried as fuel in a fascinating series of experiments. In the last issue of POPULAR SCIENCE MONTHLY, the Department of Agriculture's experimental cornstarch motor was described. Grain dust is exploded as fuel in this strange machine. Coal dust has also been employed with some success in Germany, using the Diesel engine.

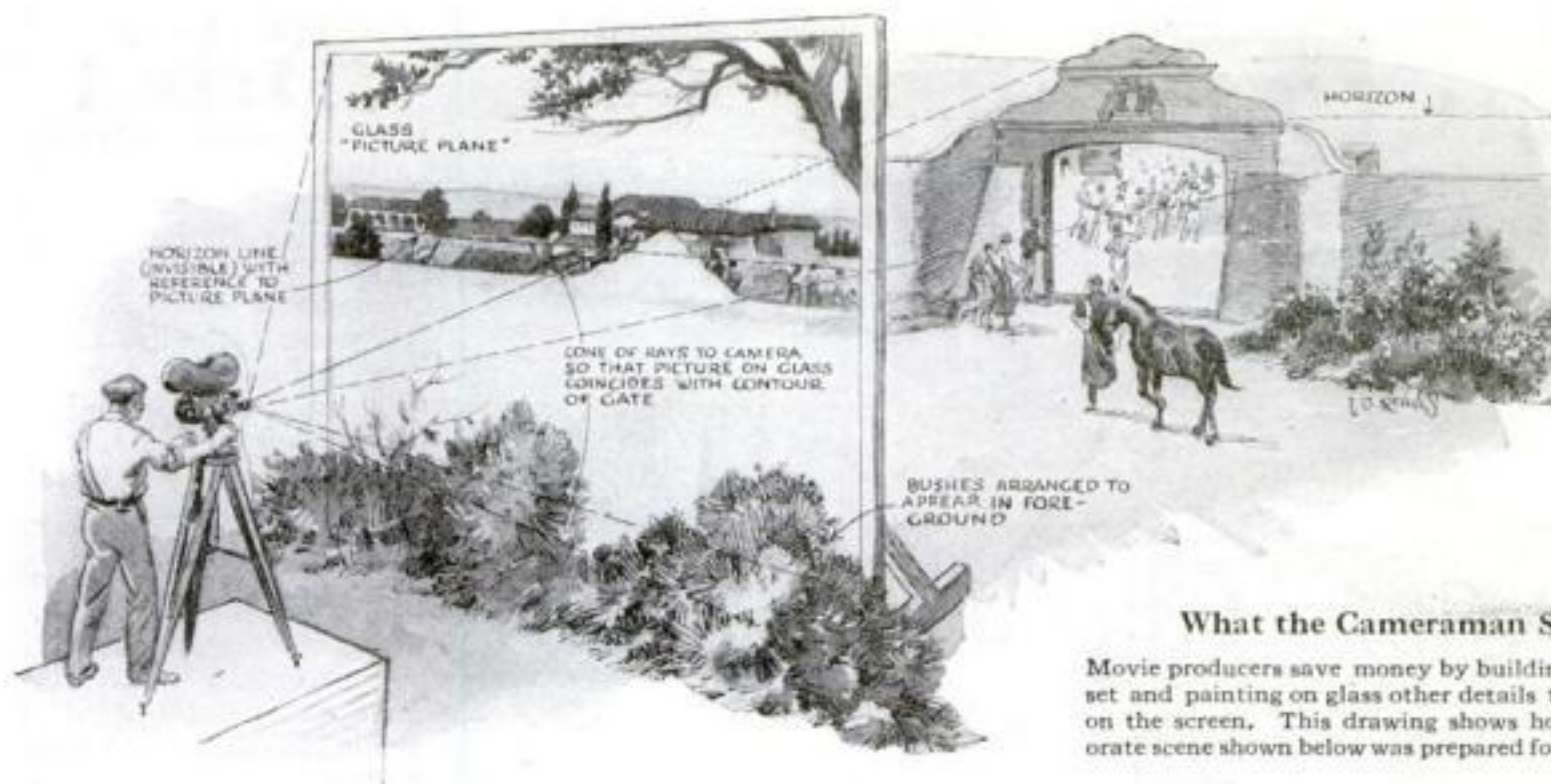
It seems to be only a question of time before one of these many processes will succeed on a commercial scale.

**GASOLINE**, which is chemically a carbon-hydrogen compound, has been synthesized some time since by Prof. Franz Fischer, director of the Institute of Coal Research in Germany, who combined the hydrogen and carbon of coal-derived water gas under tremendous heat and pressure. Now he announces a startling improvement in which these factors are no longer necessary. A new catalyst obtains the same results. A pleasant-smelling gasoline, clear as water and possessing valuable antiknock properties, is obtained. Another German, Dr. Bergius of Heidelberg, has combined compressed hydrogen directly with coal paste to make gasoline.



This diagram shows how the furnace of the French wood-burning truck is designed to generate inflammable gas which, mixed with air, is exploded in the cylinders of the motor





What the Cameraman Sees

Movie producers save money by building a central set and painting on glass other details to be shown on the screen. This drawing shows how the elaborate scene shown below was prepared for the camera

# How the Movie Camera *LIES*

*Why You Can't Trust Your Eyes While You Watch Spectacular Effects on the Screen*

By SUMNER SMITH

**T**HE camera never lies, they say. And yet—

You see the cowboy hero of a Western movie thriller, pursued by a bandit band, spur his spirited steed to a canyon's lip. Horse and rider seem certain to plunge a thousand feet to destruction. And then, just when you gasp in horror, the horse gathers his legs together, leaps high in the air and clears the abyss. A fifty-foot jump, you calculate quickly. What a marvelous animal! What courage that actor has!

Or, in a drama, you see the action begin in New York, then move to London, Paris, Cairo perhaps and back again to New York. Twenty players traveling halfway around the world to supply an hour's entertainment! Transportation alone must have cost in the thousands!

Perhaps it is one of those swashbuckling hair-raisers, set in the period when knights were bold, that you are witnessing. Brave men and fair ladies move about in a medieval atmosphere. Huge castles and palaces lend realism to the scene. Once again you are awed by the magnitude of the cash outlay that is required for backgrounds such as these.

However, in the movies, things are not always what they seem. The cowboy may never have set foot within a hundred miles of the canyon he leaped. That "globe-trotting" company of players possibly never left Hollywood or Long Island. Those castles whose size and magnificence gave you a thrill probably could be carried around on the running board of a flivver.

They were just clever paintings on glass.

More and more, as motion pictures develop, producers utilize clever illusions—tricks of photography, lighting and what may be loosely called scene painting—to make the action of photoplays more convincing. No industry—or art, if you prefer—probably has made wider use of the gifts of science or of the inventive powers of ingenious minds.

Take the glass backgrounds, for example. Not so many years ago, no director or continuity writer in an American moving picture company would have dared call for a scene showing the exterior of the British Houses of Parliament, say. Nobody knew any way to get such a scene other than by the expensive and time-consuming expedient of sending a producing company to London. Now, a

photoplay script may specify a scene in almost any location in the world and it can be made easily without transporting actors and cameramen off their own "lot."

**T**HE process is described in pictures on these pages. A scene representing the lower part of the desired location is constructed in the studio. Then, working from photographs, a clever artist copies the upper part of the building on glass. The glass painting of the upper stories begins at the place where the constructed first story stops, so that, when the time arrives to "shoot" the scene, the two may be matched together without disclosing the line of junction in the completed film.

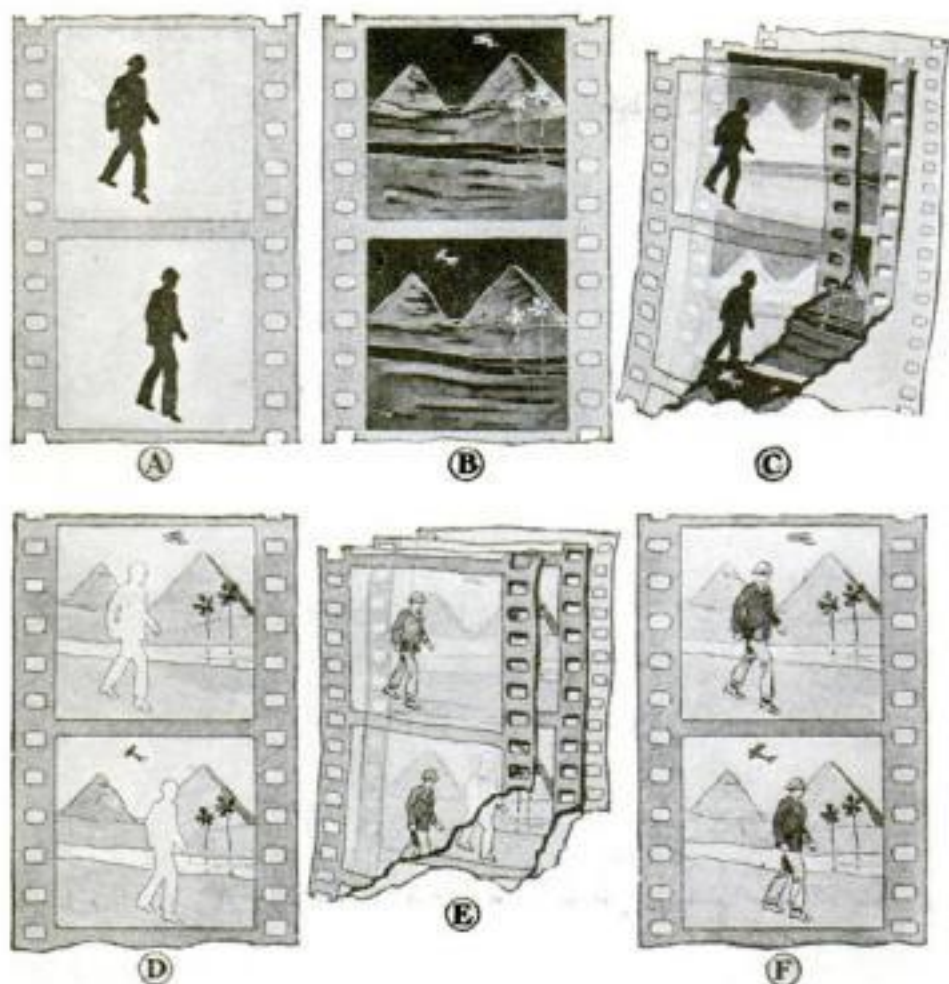
The glass part of this composite scene is smaller than the portion that has been built, but it is smaller in a certain definite proportion, in accordance with careful calculation of perspective, camera focus, and similar details. When the scene is photographed, the glass part is hung in a frame close to the camera. Then, if the calculations are right—and they always are these days—the film will show the composite building as a unit, with the actors performing in the lower part and the upper part stretching convincingly toward the sky.

The huge cathedral shown in the production of "The Hunchback of Notre Dame" was an excellent early example of this method of working with miniature glass backgrounds. In fact, so realistic was this set, that a publicity man, unaware of the details of the trick, wrote an



This is the scene depicted in the drawing above as it appeared in the film as completed for showing to movie theater audiences





### Movie Globe-Trotting

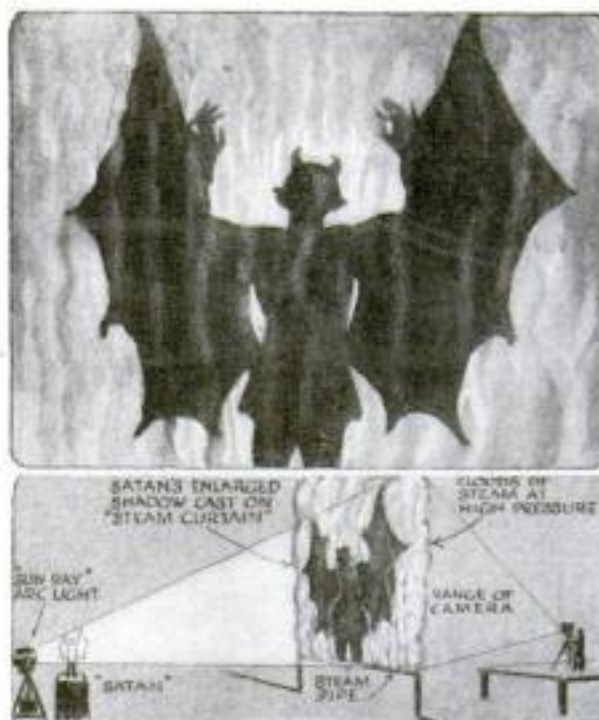
By means of the ingenious process illustrated at the left a scene photographed in a studio can be placed on a background made anywhere in the world. The drawings show: (A) an intensified positive print of an actor photographed in a studio, (B) a negative of the pyramids, (C) the printing of (A) and (B) concurrently to produce (D), a positive of the pyramids with a transparent figure of the actor; (E) the printing of (D) and an unintensified positive of (A) to produce the master negative from which the positive (F), to be used in the photoplay shown to the public, is printed.

article telling of the tremendous expense involved in duplicating the cathedral after he saw the first print of the picture.

But why go to the trouble of building a two-section set of the House of Commons, say, if that's wanted in a picture? Can't an actual moving picture of the House of Commons be made, and then the studio action placed on that picture by double exposure? Yes, that can be done, but it's no such simple process as double exposure. In fact, the method by which a scene taken in a studio in Hollywood, for example, can be transferred to an actual motion picture of, say, St. Mark's Square in Venice, is one of the most ingenious processes ever developed for the screen. Frank Williams is responsible for this amazing trick of photography, and he worked on his idea seventeen years before he used it successfully. A pictorial outline of this method illustrates this article.

**ASSUME** that a picture story requires the hero fight a duel in the shadows of the pyramids of Egypt. The duel is fought in the studio and photographed against a black velvet background. Then a motion picture of the pyramids is obtained, either actually made in Egypt or in the studio from a still photograph. The print of the duel scene is intensified with a silver nitrate solution until the duelists are shown as black silhouettes on otherwise transparent film. This film is superimposed on the *negative* of the actual scene of the pyramids and both are run concurrently through a printing machine. The resultant print is a *positive* of the pyramids containing transparent figures corresponding to the silhouettes of the duelists which blocked off the light in the process of printing. This positive and an *unintensified positive* of the original duel scene are then superimposed and run through the printer.

The movements of the actors in the duel scene coincide exactly, of course, with the transparent figures in the pyramids scene and the result is a *negative*,



### Flames of Steam

The upper picture shows a striking effect in "The Sorrows of Satan"—a shadowy figure of Satan surrounded by flames. The lower drawing illustrates how this effect was produced in the studio with a "curtain of steam"

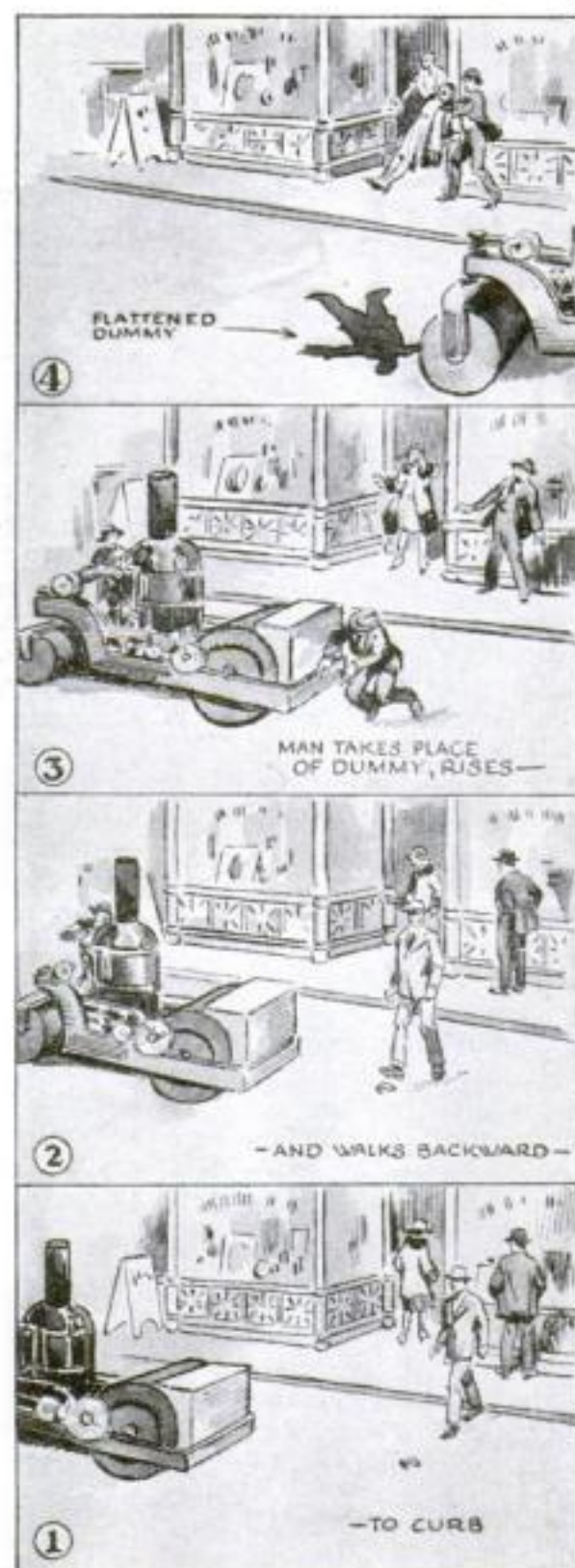
having the pyramids in the background and a duel in the foreground. From this negative the duel scene that is used in the photoplay is printed. By this method the cowboy hero can leap a fifty-foot chasm on his horse without ever leaving the studio, and hero and villain may stage an entirely convincing death struggle on the edge of a cliff without ever going near the cliff.

Few, probably, among the millions who attend the 20,233 American moving picture theatres every week are aware of the extent to which this legitimate and ingenious trickery is practiced. The secrets of their tricks are jealously guarded by film companies. Will Hays, "movie czar," has told producers that widespread understanding of film artifices would cause the pictures to lose in realism. The principal fear, of course, is that daring heroes may lose prestige. Once let it be known that

a "stunt" had been "faked" by a particular actor, and movie audiences thereafter would look with suspicion even upon his most courageous exploits.

One of the most useful devices in the cameraman's bag of tricks is the practice of turning the crank of a camera backward. When the camera action is reversed and the film run through the projector normally, the action that was pictured is reversed on the screen. Thus, if a man walking is photographed with reverse camera motion, when the picture is shown on the screen the man is seen walking backward.

**YOU'VE** seen a film hero rush toward a high wall, leap upward, catch the top and then draw himself up and over the wall? Reverse motion—nine times out of ten! What the actor really did was crawl over the top of the wall from the opposite side, drop to the ground and then run away—backwards. You've seen—especially in comedies—an actor run into the path of a rapidly mov-



How a comedian can be apparently flattened by a steam roller. The action is made in reverse, actor and roller backing while the film is run backward, as shown in the pictures above, from top to bottom. Then, on the screen, the action is shown as indicated by the numerals

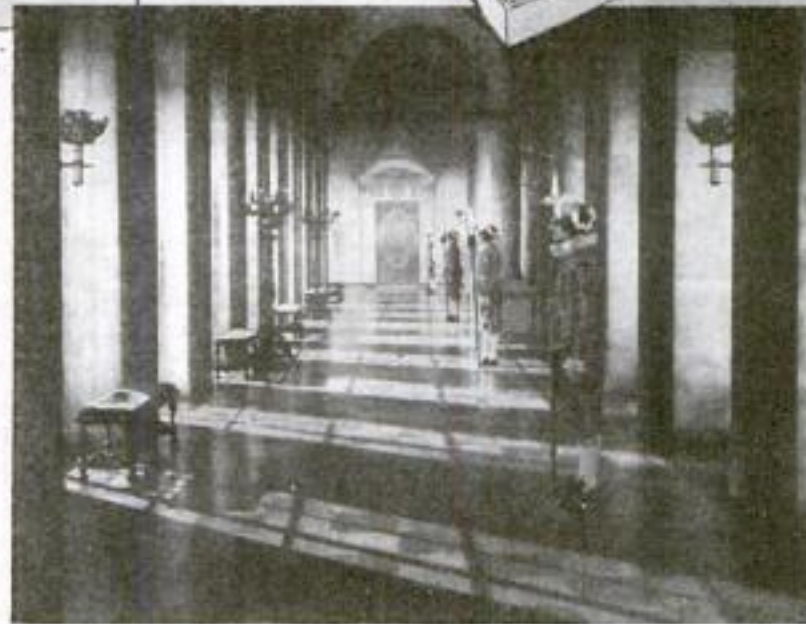
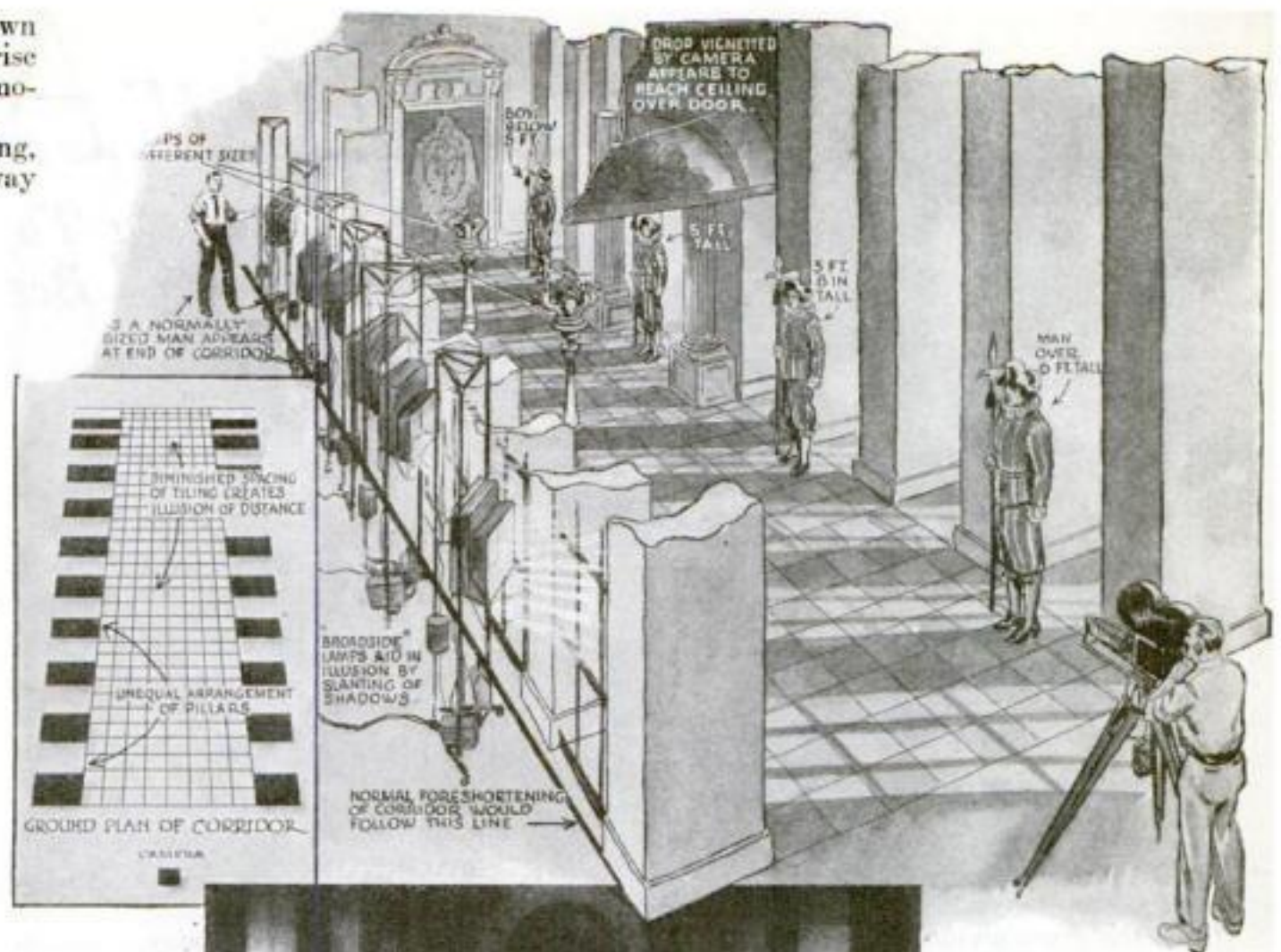


ing automobile, get knocked down and run over, and immediately arise and walk away unhurt? Reverse motion again!

As the cameraman began grinding, the automobile started backing away and the actor started walking backward toward the sidewalk. When the resulting film was run in correct sequence, the automobile was shown dashing down upon and running into the man who seemed to stroll nonchalantly into its path. In this case, another ingenious but simple camera trick doubtlessly also was employed—slow cranking. To reproduce the effect of a swiftly moving auto, the cameraman turned his crank with leisurely deliberation. When this 'slowly taken film was later projected at normal speed, the thrilled audience saw action of some duration compressed into a few moments with the resulting illusion that the oncoming car was traveling at high speed.

**W**HEN a steam roller passes over the body of an unfortunate comedian, no one believes that the flattened strip left on the road is the actor. Yet it may be puzzling to see the body rise, assume the normal shape of the comedy hero, and walk away. Here again reverse cranking was employed. At the proper time the camera was stopped, and as the machine was about to run over the luckless comedian, a cloth strip was substituted. Then the same process was reversed. Slow cranking helped speed up the action and conceal the substitution, passing over the trickery too rapidly to disclose it.

Once, when photographic trickery was new, a tragedy of the films occurred in Great Britain. An English producer saw an American film in which the hero, swinging from the cowcatcher of a speeding express train, pulled from the tracks to safety the limp body of the heroine. The Englishman didn't know that the scene was faked, that the engine backed away after the hero had dropped the lady on the ties while the camera ground backward. And when his cast attempted to duplicate the feat, from a real express train, the actress was killed.



#### Tricking the Eye

The lower picture at the left, a real photoplay scene, shows a long, vaulted corridor. Actually this corridor was only half as long as it appeared to be on the screen, but the effect of length was obtained, as shown in the upper pictures, by employing false perspective in constructing the set and using actors and objects of disproportionate sizes in the rear

Dashing bravely through the roaring flames, the hero risks almost certain death to rescue the child at the head of the fire-swept stairway—a feat accomplished without even singeing his wavy hair! Stage flames from burning clouds of lycopodium powder, highly spectacular but not even very hot, were blown across the set between the actor and the camera. So it was that many of the effects in recent war pictures were

obtained. Here, by the way, is an interesting illusion. The camera has only one eye—and it takes two to judge distance. If you shut one eye and watched them taking that picture, you would swear the man was in the midst of the flames. And so it appears on the screen.

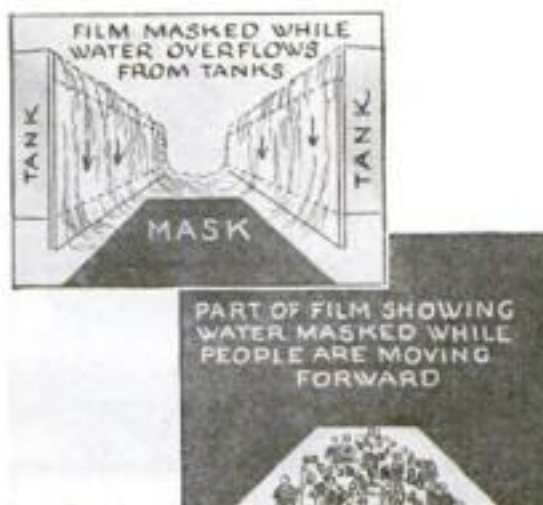
**T**HROUGH the camera's single eye, a small model of a scene at close quarters looks the same as the real thing some distance away. Albert E. Smith of the old Vitagraph Company, during the Spanish-American War, used a variation of this stunt to put over what is probably the first bit of movie trickery on record. The battleship *Maine* had just been sunk, and vivid headlines in every newspaper carried fresh messages of conflict and turmoil. People demanded pictures of the battle scenes, pictures there was no way of getting. So in his Brooklyn back yard Smith set up a tank and filled it with water. His men whittled miniature blocks of wood to resemble battleships, and Smith pasted newspaper photographs of the ships to their sides.

Smith with red-hot wire set off tiny charges of powder behind the miniature battleships. What the camera, steadily grinding a few (Continued on page 125)



#### All Done on Dry Land

In "The Ten Commandments" the Red Sea parted to permit the passage of the Children of Israel and then closed upon the pursuing army of Pharaoh. This amazing effect was produced by double exposure and reverse motion as shown above, the waters being photographed in a small trough





# Do Our Athletes

*It's a Toss-Up Between the Better--How Do You*

By ARTHUR  
GRAHAME

## They All Turn Out

In the olden days only the star athletes engaged in college sports contests. Today virtually all students take part in competitive athletics of some kind as part of the curriculum. Here is a typical gymnasium scene at Columbia University



**“W**HY, when I was in college . . .” No need to go further. You know the words and music of the song that the old grad loves to sing. Its burden is ever the same—that in these soft and effeminate days we don’t grow the sort of men who used to wear the dear old Black and Blue. Your dad sings it to you; his dad sang it to him; and you’ll sing it to your son when he has the impudence to try to tell you that Biff Brown, 1942, is the niftiest and shiftiest back who ever twisted a pair of snaky hips out of reach of the itching fingers of a would-be tackler. “Why,” you’ll say scornfully, “back in ’26 we had a fellow named. . .”

Oh, well, what’s the use? There are few really new things in this old world, and most of those few are neither ideas nor arguments. But facts always are valuable and sometimes are interesting. I decided that I would try to get the facts in this case; that I would try to learn whether the athletes—especially the college athletes—of a quarter of a century ago really were better than are the athletes of today.

**I**N QUEST of this information, I called on Dr. William Gilbert Anderson, director of the Yale University gymnasium. Dr. Anderson has devoted his life to physical education. He has traveled, and studied mankind, in many parts of the world, and holds degrees from several universities. For more than thirty years he has been a member of the Yale faculty, and for most of that time has been director of the gymnasium. During his career he has seen many college generations come and go. Few men have had equal professional training, and as few have had equal opportunity for studying the college student, both the athlete and the nonathlete, at close range.

I found Dr. Anderson in his pleasant office in the gymnasium building. He is a man who has practiced what he has preached and still preaches—sensible living; a tall, erect, white-haired, dignified gentleman who isn’t afraid to smile. He smiled when I asked him my question about athletes.

“A really great athlete,” he said, “is an

exceptional man. There were great athletes at Yale twenty-five years ago, there are great athletes at Yale today, and there is no reason for thinking that there will not be great athletes at Yale twenty-five years from now.

**“T**WENTY-FIVE years ago—that would be 1902. Two of the greatest football players who ever lived played for Yale in 1902—Tom Shevlin and Jim Hogan. But there have been great Yale football players since their time—Bomeisler, Kilpatrick and Ted Coy, among others. And there have been other fine Yale athletes. There was Al Sharpe, who won his letter in football, baseball, track and basketball. There was A. C. Gilbert, who held the pole-vault record, was the champion gymnast of the university, an expert boxer and wrestler, and the most skilled sleight-of-hand man that I’ve ever watched. And there have been many others. The only difference that I’ve noticed between the athletic star of twenty-five years ago and the athletic star of more recent years is that the outstanding athlete of today seems to be more

versatile. But that probably is accounted for by the fact that now there are more sports in which an athlete may participate, rather than by any change in the men themselves. The great athlete of today has exactly the same qualities as had the great athlete of any other period. He is an exceptional man, and you can’t draw any very illuminating general conclusions from

the study of exceptional men in any line.

“But it is possible to draw valuable conclusions from the careful observation of large numbers of men. A careful study of the college freshman of today shows that he is a better man physically than was his father when he entered college. The change, of course, has been small, but it has been in the right direction. I think that this improvement has been brought about by supervised athletics and physical training in the preparatory schools.

**“E**ACH Yale freshman, shortly after he enters college, receives a thorough physical examination. The data obtained from these examinations has been tabulated and studied, and it proves these things about the average freshman of today, as compared with the average freshman of twenty-five years ago:

“The freshman of the present is taller. He has gained, according to the figures, a full inch in height. This increase in height perhaps is more apparent than real, for very possibly it is a result of better



## Could They Win on the Gridiron Now?

The Chicago University football team of 1892. Then players were men in appearance as well as in fact. Is the smooth-faced college football player of today superior to his bearded and mustached predecessor? A careful study of the two has shown interesting and surprising results



# Equal Stars of Old?

*Great Ones, But the Average Today Is Compare with Modern College Men?*

posture. The average young man of today stands up straighter than did the average young man of twenty-five years ago. That is an improvement much more important than an actual increase in height.

"The freshman of the present has a better chest. He has gained an inch in chest measurement. This also, I think, is partly the result of better posture. The man who stands straight breathes deeper than the man who stoops, and deep breathing increases chest capacity.

"The freshman of the present is a few months younger, and about a pound lighter.

"**I**N PASSING, I might say that the average young man who enters Yale is, according to the latest available figures, a few months under nineteen years old. His height is 5 feet 9.9 inches; his chest measures 36.7 inches; and he weighs 144.2 pounds.

"While this improvement is encouraging," continued Dr. Anderson, "it does not mean that most of the young men who come to Yale are free from physical defects. In a recent freshman class 339 men were round-shouldered, 162 were flat-chested, 285 had kyphosis, or stooped shoulders, and most of them had lateral curvature of the spine. Nearly a hundred of them had flat feet, or were threatened with fallen arches. In many cases these conditions can be remedied by proper exercise. This body-building work is carried on under the direction of my brother, H. S. Anderson, and Robert Kiphuth. Gymnasium work is compulsory for the freshman, unless he shows special interest in and aptitude for some sport and has no serious defects to be corrected by special exercise. To be graduated from Yale, a man must be able to swim, and swimming is one of the most popular of the indoor sports. Boxing, basketball, wrestling, squash and fencing also are popular. If you will come with me, I will show you something interesting."

**H**E LED the way down a corridor to an open door. In a large, well-ventilated room forty or fifty young men, stripped to the waist

and sweating freely, were cheerfully going through a series of calisthenics whose severity would have brought growls of protest even from well-disciplined soldiers.

"That," said Dr. Anderson, "is Bob Kiphuth's swimming squad going through some of its preliminary training. As you know, he is one of the most successful of the college swimming coaches. Almost every young man who comes to college wants to 'make a team.' We use that perfectly natural desire to help make our body-building work interesting. If those same boys had been ordered to go through that same work just because they needed it, they would have done a lot of discussing and not a little cussing over it. But so long as it is a part of the training for a recognized sport they undergo it willingly. No matter what sport a freshman takes up, we see that he gets some of the body-building work that he needs.

"**P**ERHAPS you noticed," he went on when we were back in his office, "that although those young men were going through the same exercise, they were not working in unison. We have found by experience that allowing each man to use his own sense of timing gives more satisfactory results than asking for the sort of precision that is demanded of soldiers at drill. In the last twenty years gymnasiums have changed far more than have the men who use them. Dumb-bells and Indian clubs have become relics of the past. You will find but little apparatus in the modern gymnasium. We have learned from the Germans and the Swedes that free calisthenics are better developers than work on the horses and the parallel bars.

"Personally, I would be well content if we could teach every man who comes to the Yale gymnasium to

## Marvel of His Day

Fifteen years ago, Ted Coy, Yale football star, was hailed as a marvelous all-round athlete. The great athletes of today, says Dr. Anderson, have the same exceptional qualities as the famous stars of the past



**A Famous Runner of the '80s**

Lon Myers, in the '80s the world's most versatile performer on the track. At one time he held world's records for events ranging from sprints to long distances. Since then all his records have been eclipsed. Would Myers have a chance with star track men of today?

do two things—to keep the back of his neck against his collar, and to relax now and then.

"Correct posture is a necessity for good health. It gives the organs of the body a chance to do their work properly. It is largely a matter of habit, and it is not insisted upon as strongly as it should be in most of our preparatory schools. It can be practiced at any time and in any place—while you are walking on the street, while you are sitting at your desk, while you are dressing, while you are driving your automobile. Just lift your head, draw in your chin until the back of your neck presses against your collar, arch your chest to its utmost, and draw in the abdominal muscles. Do that twenty times a day, holding the position for five seconds each time, and in a few weeks you will find that your posture is greatly improved. You will look better, and—more important—you will feel better. It will take less than two minutes of your time a day to form the good habit of standing correctly, and it will exercise most of the important muscles of your body. I give that advice to every freshman who needs it, but I'm sorry to say that not all of them follow it.

"**T**EACHING college boys to relax is an almost hopeless task. Most of them aren't organized that way. Yet every day I see business and professional men 'tied up' and in that way squandering energy that they need. If in their college days they had been taught to relax for a few minutes every hour or so they would last *(Continued on page 111)*





# MARVELS We May See in 1927

## Leaders in Many Fields of Science Forecast an Amazing Future for Us

### Medicine and Surgery

WILLIAM J. MAYO, M.D., Sc. D., LL. D.  
*Surgeon, Mayo Clinic, Rochester, Minn.*



**T**HE invention of the microscope made possible the epochal work of Pasteur, which brought about the popular recognition of the role of microorganisms in the causation of disease. As a result, the scourges of contagious and infectious diseases have nearly

disappeared in civilized countries.

Today vision is being extended into the ultramicroscopic field which concerns those biochemical changes which bring about the degenerative diseases of middle and later life. The increasing proportion of deaths from cancer and diseases of the heart, kidneys, and other vital organs affords hope for the future rather than discouragement, because these are the affections of middle and old age and prove the advance of the medical frontier. In the older day, the greater number of human beings died before the period of life at which these diseases develop. Our newer knowledge of the colloid and molecular changes in the tissues and fluids of the human body is vitally influencing the practice of internal medicine through methods which lead to immunization and reconstruction.

As for surgery, rehabilitation by physicochemical means, by which the patient is restored to as nearly normal condition as possible before surgical operation, is enabling surgery to obtain astonishing results.

### Ocean Transportation

REAR ADMIRAL BRADLEY A. FISKE, U.S.N.  
*Marine Engineer, Inventor*



**O**NE of the most important advances in ocean transportation in 1927 will be the increased use of the Diesel engine, in both direct acting and geared forms and also for driving small electric gener-

ators that feed motors on the propeller shafts. The Diesel engine has come to be such a menace to the steam engine that boiler and engine makers are prosecuting elaborate researches to enable the steam engine to meet the competition; mainly by making higher pressures practicable and by the use of pulverized coal. At the moment, the latter seems to be the more promising method of combating the

competition, at least for the Merchant Service.

The use of radio and of scientific apparatus and methods will increase; especially for direction finding, hearing submarine bells, ascertaining the depth of water and the like.

The advance which will be the most significant as to future events will be the increasing importance on the sea of Germany, Italy and Spain. The magnificent combination of inventiveness, constructiveness, foresight, industry and courage which the German people possess, has already almost put Germany back where she was before the war.

Meanwhile, the United States will continue to fall behind with rapidly increasing speed. In a few years, she cannot fail to be at the rear of the maritime nations. Then those nations will feel a temptation (perhaps beyond human resistance) to blockade her trade routes and seize her wealth.

### Zoology

W. T. HORNADAY, Sc. D.  
*Zoologist; Former Director, N. Y. Zoological Park*



**I** PREDICT that at its next session the Sixty-Ninth Congress will pass a new bill to provide federal sanctuaries for migratory birds, and the Copeland-Merritt bill to reduce the bag limits in twenty-three states on migratory game.

I predict that next year a good number of state legislatures will enact new laws to safeguard the surviving remnants of their vanishing wild life.

I predict that the great awakening now taking place throughout the United States on the subject of the extermination of wild life will culminate in 1927 in a nation-wide demand for drastic reforms in our present fearfully weak, inefficient and deadly system of wild life protection.

I predict that in the fall of 1927 the voters of Cleveland, Ohio, will vote a special tax law, of one tenth of a mill for five years, to meet the cost of important new zoological developments in that city. This would give Cleveland a thoroughly modern and up-to-date zoological park, already designed, to cost \$1,500,000, and it will be followed in due course by an aquarium and a botanical garden.

Finally, I predict that in 1927 the efforts now being made in the New York Zoological Park to breed the vanishing musk-ox of Arctic America in captivity will be successful; and that the capture of musk-ox calves on the east coast of Greenland will be prohibited for five years.

### Polar Exploration

VILHJALMUR STEFANSSON  
*Arctic Explorer*



**I**N EVERY respect but one, the sensational Arctic flights of 1926 merely advertised to the public the tried knowledge and accepted deductions of the scientists. The one exception was when Wilkins reported the definite absence of land in a pre-

viously unexplored area of ten thousand square miles north of Alaska, and when Amundsen reported the same thing a few weeks later for a previously unknown strip also on the Alaska side of the Pole. These results were expected by about half the scientists and unexpected by the other half.

Two things that were much debated, and which therefore come near the field of actual discovery, were settled by Byrd and Wilkins. These two flyers showed not only that the winter Arctic climate is peculiarly favorable for flying, as compared with average temperate or tropic climates, but also that air bumps, air holes, and roughness of the air generally, while appearing in spring and (doubtless) through the summer, are absent in the Arctic in winter.

The Argentinians are to fly in the Antarctic the coming year; Wilkins, Nobile, and others have announced they will fly in the North. Others, such as Byrd, may fly there also. What we may expect is that these flights, if made, will further confirm scientific opinions.

It seems certain that no new land can be discovered in the Antarctic; there is a fifty-fifty chance that islands will be discovered in the Arctic.

### Geology and Mining

THEODORE J. HOOVER  
*Professor of Mining and Metallurgy, Leland Stanford University*



**R**ECOGNITION by the public that we are spending our mineral resources "like a drunken sailor," and that their exhaustion is within measurable distance, would be the most important

thing that could happen in geology and mining in 1927.

Any advance in this direction, and there will be some advance, though small, will be the most important advance in this field for 1927 or any other year.



## Bacteriology

EDWIN O. JORDAN, Ph.D., Sc.D.

*Professor of Bacteriology, University of Chicago*



**I**T SEEMS probable that we are on the verge of important discoveries in the bacteriology of measles, and that a specific microbe will soon be firmly established as the causal agent of this infection. In tuberculosis, results of the vaccination of children by Calmette's method are highly impressive; every year adds to their significance.

In 1927 we are likely to learn important facts regarding the nature of virulence and its correlated characters, the nature of bacterial toxins, the causes and meaning of bacterial variation, the specific soluble substances of bacteria and the nature of bacteriophage. We may expect to have light cast on several obscure immunological phenomena.

We shall probably know something more by the end of another year about scarlet fever, poliomyelitis (infantile paralysis) and possibly epidemic encephalitis. The identity of the African disease resembling yellow fever is likely to be established. At any time important discoveries may be made in the field of filterable viruses, and in such baffling infections as chicken pox, canine distemper and the mosaic disease of tobacco.

## Mechanical Engineering

DEXTER S. KIMBALL, M.E.

*Dean, College of Engineering, Cornell University*



**O**NE of the outstanding features of modern mechanical engineering is the growth in size of industrial machinery. The first locomotive weighed about four tons, while some modern locomotives weigh more than 300 tons. The first electrical generators were mere toys; we are now building turbo-generators that can produce 50,000 kilowatts from a single unit. It is not likely that we have reached the limits of construction in any field demanding large apparatus, and it is interesting to speculate what the maximum size of such machinery may be.

We shall probably see a considerable development in Diesel engines and other

internal combustion engines using oil and other liquid fuels. This development will probably be in the direction of increased size of units. Already this form of prime mover has made a place for itself in marine work, and efforts to apply it to locomotives, automobiles and even flying machines have a fair chance of being successful.

We shall see, also, a continued extension of the methods of quantity production. Our successes in producing clothes, shoes, sewing machines, automobiles and many other products at prices unattainable by older methods make it certain that we shall extend these methods to other lines.

## Radio

ALEXANDER SENAUKE, M. E., E. E.

*Radio Engineer, Popular Science Institute of Standards*



**T**HE year 1927 will see a great awakening on the part of the general public to the value of faithful and accurate tone reproduction in radio reception. Tremendous strides along this line have been made by the manufacturers of radio receivers and loudspeakers, and broadcast listeners will be educated up to a new standard of quality.

The novelty of receiving distant stations is wearing away, but modern receivers are being made more and more sensitive and selective so that the vast listening public located away from the big cities will be able to choose exactly the program desired.

A new radio law probably will be enacted that will iron out the difficulties with interference now causing trouble in some sections, and there is a strong possibility that licenses to broadcast will be restricted to stations able to broadcast worth-while features.

Programs will continue to show steady improvement in quality and variety and a system may be worked out between stations in the same locality so that several stations will not broadcast the same type of feature at the same time. By this arrangement the listener who is partial to some particular form of radio entertainment will be able to tune-in the type of broadcasting that pleases him at any hour of the day and will not have to miss one of two features because both are on at the same time.

## Chemistry

EDWIN E. SLOSSON, Ph.D.

*Chemist, Author, Director of Science Service*



**T**HE hormones, which determine whether we shall be tall or short, handsome or homely, brilliant or dull, cross or congenial, will soon be made in the laboratory, instead of exclusively by the old-fashioned and unreliable action of our glands. And since the chemist is never satisfied with merely imitating nature's products, he is likely to devise something more effective in this field, as he has in dyes and drugs.

In fact, we seem to be entering a new epoch of organic synthesis. Artificial petroleum is now made from coal and hydrogen. Petroleum can be converted into all manner of physiological compounds, including alcohols and fats. Methanol is made from water gas. So man is being freed from his exclusive dependence upon plants and animals for his food and medicine, and may ultimately be able to make what he wants from air, water and coal, in all cases where the factory can compete profitably with nature.

We may predict that in 1927 one or more of the elusive vitamins will be run down and identified, possibly synthesized. It is already known that cholesterol, which has been regarded hitherto as stuffing up the cell to no purpose, can be converted into a vitamin by the action of ultra-violet rays, and so serve as a cure for rickets. In like manner means of activating other inert substances may soon be found.

## Electricity

ARTHUR WILLIAMS

*Vice President, New York Edison Company*



**T**HERE will be growing appreciation of the value of electric power as an agency for improving the social and economic life of the country; this will be true not alone in the home and in our industrial life, but in that of the American farmer, a field which is as yet substantially untouched. There

## A Year of Thrilling Revelations Ahead of Us!

**I**F SOMEONE should ask you today what great new discoveries and inventions you would like to see, you might be at a loss for an answer.

Within our lifetime new knowledge and new utilities for our comfort, happiness, and well-being have come upon us, and it sometimes seems as if nothing more remains to be supplied.

Has science, in its progress, reached the top peak of achievement? Or is it progressing toward rev-

elations that will still further change our lives?

Recently we put these questions to twenty scientists. Their answers appear on these pages. They leave little doubt that we are merely on the threshold in invention, physics, astronomy, biology, psychology, and all the rest of the sciences. They assure us that the achievements of the past few decades, marvelous as they seem to us, are indeed small compared with what the future holds.



# Marvels We May See in 1927

will doubtless be an increasing understanding of the real meaning and value in service of the term "superpower"; a wider realization of the fact that superpower does not relate to politics, but to economics; that it is an agency already long in existence, through which, by means of interconnection, widely separated but large and economical sources of power generation can be united, with as a result more efficient utilization of the power source and greater security of the service to the individual consumer.

## Physics

ROBERT ANDREWS MILLIKAN, Ph.D.,  
Sc.D., LL.D.

*Physicist, Nobel Prize Winner, Head of the California Institute of Technology*



**WE ARE** clearly approaching a reconstruction of the formulation of a considerable part of that branch of the new physics which is included under the general designation, quantum theory.

The simplifications and generalizations which have been introduced this year into spectroscopy by Hund, Lande, Pauli and Russel, the new theoretical formulation of Schrödinger, with its application to the Stark effect by Epstein, and the new mechanics developed by Heisenberg, Born, and Jordan; all are indicative of the heroic efforts just now being made to eliminate some of the contradictions in modern physics, and to place the whole structure upon a new basis of experimentally observed facts.

## Psychology

ALBERT EDWARD WIGGAM  
*Biologist, Writer and Lecturer*



**THE** main drive of psychological inquiry in 1927 will be testing the mental tests, devising tests for character and personality and moral and volitional traits, and determining better the nature of intellect itself.

Some important researches are under way in this latter field. Very important researches will be published in April on the problem of heredity and environment.

New efforts will be made to measure the special aptitudes of high school and college students and to devise emotional incentives that will lead students to measure up to their highest capacities. Two big projects are under way in this direction. A number of colleges are planning a regular psychological consultation service for aiding students in their problems, both vocational and personal. Clinical psychology is rapidly advancing in the devising of methods for removing fear and relieving the depressed mind.

## Astronomy

CAPTAIN EDWIN T. POLLOCK, U.S.N.  
*Superintendent, U.S. Naval Observatory, Washington, D.C.*



**TWO** important projects are now under way at the U. S. Naval Observatory, Washington, D. C., as well as at other observatories, and while 1927 will not see their finish it will see a good beginning.

One is the observation of positions of certain stars to be used in the "Eros Campaign" of 1930-31, when the planet Eros will be used in a newer determination of the solar parallax, or difference in the apparent position of the sun and its true place. Eros, which at times is nearer to the Earth than any other heavenly body except the Moon, will be only 16,000,000 miles away from us in 1930. Mars, at its nearest approach in 1924, was 35,000,000 miles away.

The other project is the "round-the-world" longitude determinations, for which special time signals have been sent these last two months by the United States naval radio stations and for which at the same time astronomical observations were made all around the world. The calculations may be completed during 1927.

These findings will be a start toward proving or disproving the theory that the continents do move and that our moon came from the Pacific Ocean. If it is found that the continents move or that parts of the earth expand or shrink, it may show, as some believe, that it is the Earth and not the Moon which is erratic in its motion. But the most important advance that could be made in astronomy in 1927 would be to have some one donate the millions needed to construct a telescope larger than any now in use.

## Automobile Engineering

EDWARD V. RICKENBACKER  
*Automobile Racer; Aviator*



**OUR** ever-increasing highway congestion, in the writer's opinion, demands the following development in motor car engineering:

Smaller, higher-speed and lighter engines, resulting in greater economy, shorter wheel base and lighter complete cars at less cost.

Lower center of gravity, brought about through double drop frame, worm gear drive or a design giving similar results.

Smaller diameter tires with greater cross section, eliminating the necessity of wheels and using brake drums as substitute. Tires would be mounted directly on the brake drum, permitting brake application on all four wheels directly over the center of the tire.

Rubber spring shackles as a substitute

for bolts, eliminating squeaks and the necessity of lubrication.

Simplification of starting problem in cold weather by electrical vaporizers or some equally effective substitute.

Increased compression ratios and the elimination of carbon through the use of antiknock fuels.

I believe motor car engines of the better class will be equipped eventually with superchargers for the purpose of reducing weight and to increase the horsepower per cubic inch of displacement. This will be followed by the supercharged two-cycle design for the same purpose.

## Anthropology

CLARK WISSLER, Ph.D.  
*Curator of Anthropology, American Museum of Natural History, New York City*



**BECAUSE** of the large number of explorers in the field, there is reason to expect new finds of fossil man in Europe, western Asia, or in Africa, the regions so far furnishing us with specimens. Also in North and South America we

may expect new finds suggesting the association of aboriginal man with the mastodon and other extinct animals.

In Mexico and Central America, ruined prehistoric cities may be discovered and more dated Mayan monuments found in them, thus adding to our knowledge of aboriginal America.

The crossing over of the American Indian from Asia to Alaska is a subject now to the fore, and a full half-dozen scientists are ransacking the shores of Bering Sea for traces of the earliest crossing from Siberia. We may expect, therefore, new evidence of Asiatic visitors to Alaska long before the days of Columbus.

About the only remaining spot on earth where white men have not roamed is the interior of New Guinea, where still live a few tribes of men not seen by the paleface. This area is now about to be explored, and we may look forward to the last round-up of primitive man.

## Agriculture

WILLIAM CROCKER, Ph.D.  
*Botanist; Director, Boyce Thompson Institute for Plant Research, Yonkers, N. Y.*



**THE** stage is set for rather large advances in plant science in all the branches mentioned below.

We can expect improved varieties of some of our food plants—varieties which give greater yields, greater resistance to disease and insects, and higher quality. Further advances in hybridization or crossing will teach breeders

(Continued on page 140)



# "Now HOW Did You Get That Cold?"

*Probably from the Man Who Sneezed in the Street Car, Answers the Doctor—  
What to Do for a Speedy Cure*

By FREDERIC DAMRAU, M.D.

**I**F I were to list all the times in my life that a stuffy nose and watering eyes have interfered with my business and social affairs, spoiled my pleasures, ruined plans and temporarily blunted my ordinarily good judgment in professional matters—I'd have to conclude that the net result would place the common cold at the top of the list of all the serious illnesses I've ever had.

Most men, if they think back a moment, will find that this holds true in their cases too.

Public and doctors have long regarded the stuffy nose as a trivial complaint, a necessary but not very important evil. Colds come, —but they have a way of going, too—usually as mysteriously as they came. As a result, little effort has been made to study their causes and prevention, and the common cold still is one of the stepchildren of medicine.

As a matter of fact, a cold may be far from a trifling inconvenience, even from a medical standpoint. It may pave the way to some devastating infection, such as pneumonia. You may start out with a cold but end with an ear abscess or even a mastoid infection. It may develop into an even more serious affliction. In short, a cold may indirectly cause death.

It puts more people on the sick list than

## An Expensive Ailment

**C**OLDS cost each of us an average loss of ten days' activity annually, so what Doctor Damrau says on these pages about their prevention has a dollars-and-cents value.

"The germs that cause colds," he points out, "can be projected twenty feet in ordinary conversation. These germs can transmit the ailment only during the first twenty-four hours of the illness. If everybody with a cold, therefore, would stay home at least the first day, the spread of the disease would be materially reduced."

any other illness. Nine out of ten of us have at least one every six months. The average man manages to "catch" three to four of them a year.

The Metropolitan Life Insurance Company kept statistics over a period of one year to find out just how many colds were caught among 6,770 of its clerical employees. There were 2,824 cases so severe as to keep the persons from working, and the average number of days lost in each case was 2.2. But these figures do not take into account the much larger number of sufferers with colds who nevertheless come to work and struggle through their duties as best they can.

**B**ECAUSE it keeps so many persons out of work a certain number of days each year and because hardly anyone escapes it entirely, the common cold probably causes more loss in dollars and cents than any other disease. For these reasons, if for no other, it is demanding the attention of physicians as never before. They are learning its causes, and are discovering ways to prevent and treat it.

"Where in the world did I catch that cold?" probably is the first question you think of when you begin to feel the stuffiness that you know will be followed by several days of nasal misery. Then you recall how you sat next to an open window, or went out into the slush without your rubbers. "That's where I caught it," you say to yourself.

But have you ever stopped to consider how often you are exposed to drafts or get your feet soaked without the sign of a



cold? Most of us meet with these hazards very often, yet we suffer from a cold only occasionally during the year. A few weeks ago I went to a football game with four friends. When the game was half over we were caught in a cold drizzle of rain. Although our clothes were drenched and our feet soaked from standing in the mud, we remained until the final whistle. One of us caught a cold and, of course, blamed the drenching. But what about the other four?

It is true that colds are most common during the winter months. From observation of more than 13,000 persons, the United States Public Health Service tells us that colds are most frequent in October. The second wave strikes the country around the Christmas holidays, after which there is a gradual decrease in the number of cases until summer.

**T**HIS would appear to point to cold weather as a factor in the onset of colds. But bear this important point in mind: Colds break out all over the country at the same time, from shivering Boston to perspiring New Orleans, and from the sleety streets of New York to the warm sunlit avenues of California. The average fellow naturally blames the weather for his cold; but do the facts justify him?

Dr. D. F. Smiley, of Ithaca, made a statistical study among 2,485 Cornell students to test some of the popular beliefs about the causes of colds. He found that students who protected themselves from drafts caught as many colds as those who slept by an open window. Those who were careful to wear rubbers or galoshes during wet wintry weather did not escape any more than did their more stoical fellows. The much vaunted cold bath in the morning proved only of slight value in preventing colds. Among the students who wore woolen underwear, colds were nineteen percent more common than among those who wore light under-clothing!

The truth of the matter is that drafts,



The mother who bundles her sniffing child up but lets him pass his whistle, germs and all, to his brother, is on the wrong track, doctors say. The whistle is a fine germ carrier



wet feet, failure to wear woolen underwear, and a host of other superstitions taught by our grandmothers have been greatly exaggerated as causes of colds. Meanwhile few of us realize the really important causes, which physicians have established by careful observations and laboratory experiments, and which must be understood if we are to escape future colds.

The majority of colds are due to infection. They come to you as a gift from your neighbor in the trolley car, who, having a cold himself, generously sprays it about as he sneezes in order that others may partake of the benefits of the stuffy nose.

**W**HILE almost anyone nowadays admits that a cold may be contracted by kissing, surprisingly few realize they are in danger when somebody close to them sneezes without using his handkerchief. But it has been proved that droplets containing microbes may be projected across a room twenty feet wide during the course of ordinary conversation. How far, then, can those same droplets travel when propelled by the high-powered artillery of a lusty sneeze? I recall vividly one such sneeze indulged in by a guest at a social gathering attended by about twenty people. Within the next few days at least half of those present, including a number who were in an adjoining room at the time, were suffering from colds.

The evidence that many colds are of microbic origin is undeniable. At the Rockefeller Institute, in New York City, Drs. Olitsky and McCartney inoculated nineteen healthy volunteers by swabbing the inside of the nose with the secretion from a man with *coryza*, the medical term for the common cold. The great majority of these healthy subjects promptly developed a cold.

**T**HE germs responsible for *coryza* are among the tiniest known. They are *ultramicroscopic*; that is, they cannot be seen with the strongest lens of the microscope. Furthermore, they will pass through a filter impermeable to all germs of ordinary size. A drop of water could contain millions of them.

An important fact about the transmission of these germs is that it is only during the first twenty-four hours of the illness that the ailment may be transmitted to others. In other words, if everybody with a cold could be made to stay at home at least the first day, the most important cause of its spread would be eliminated.



The proper thing to do for a cold of any degree of severity: Stay home; stay in bed; send for the family doctor

Your general vitality seems to play very little part in determining whether you will come down with an infectious cold or not. You may be a champion athlete or a swimmer of the English Channel, but if some fellow with an early cold sneezes the cold germs into your face, the chances are that you will be sniffing before long.

If a lowered state of vitality played an important part in the development of colds, it would be natural to expect consumptives to be highly susceptible. As a



#### If a Drenching by Rain Gives Us Colds—

Why doesn't it affect all of us that way? Of a party of five who recently sat, rain-soaked, through a football game, only one caught cold

matter of fact, however, patients in sanatoriums for tuberculosis suffer much less from colds than healthy persons. The probable explanation is that the open air life and correct living conditions in the sanatoriums greatly diminish the danger of spreading the causative microbes from one person to another.

A great deal has been said, written and done about preventing colds, but little has been accomplished. Woolen underwear, galoshes, and draft-proof bedrooms certainly will not stave off colds. Cold showers have been shown to be without value in this respect. Vaccine treatment is illogical, inasmuch as vaccines have been proved to prevent only such diseases as do not occur a second time in the same individual, as typhoid, for example.

**T**HERE is only one way to prevent colds, and that is to keep the other fellow from treating the whole crowd to the microbes from his nose and throat. To this end, the surest prevention is to avoid overcrowding in street cars, movie houses and other public places and educate the indiscriminate cougher and sneezer to the proper use of the handkerchief.

So long as people continue to be generous with their microbes, colds will be unavoidable. The fear of drafts and wet sidewalks and the utter contempt for germs as causes of disease seem to be fixed habits of thought in the average mind.

Just the other day, I saw a young mother carefully bundling a small boy up in woolen sweaters, coat and muffler as if preparing him for a flight with Commander Byrd over the North Pole. The little fellow apparently felt too warm and objected strenuously.

"Now don't take those sweaters off," she admonished. "You have a bad enough cold already."

At this juncture, another child came out on the porch.

"Let brother have your whistle," continued the mother to the wearer of the bundle of sweaters; whereupon the latter took the whistle out of his mouth, added a few coughs and sneezes, and handed it to his brother, microbes and all.

The use of the common drinking cup is a prevalent source of danger. I know of a family which complains of a continual round of colds, yet never seems to consider that these colds may be passed from one member of the family to another by using the same glass in the bathroom. The lips that touch the rim of the glass leave germs there for succeeding drinkers. And it is this unstinted generosity that keeps the doctor's telephone buzzing.

**M**OST of us use the word "cold" in entirely too free a sense. Strictly speaking, the term should be limited to the congestive, watery and discharging condition of the mucous membrane of the nose that medical men call *coryza*. It is true that the common cold may extend down to the throat and into the bronchial tubes. But I have heard persons speak of influenza and even pneumonia as "bad colds," whereas they are entirely distinct diseases. The

person with a severe *coryza*, or common cold, may feel about the same as the fellow with the "flu"; but to the doctor these two ailments are separate diseases that must not be confused. The person who takes it for granted that his illness is nothing more than a cold may really have influenza, pneumonia, or even diphtheria.

The word "cold" implies that a low temperature has something to do with the illness. The popular use of this term to designate nasal stuffiness is unfortunate, because the public has unduly magnified the importance of exposure.

Colds caught by a bride and her father at the bride's wedding, for example, formed the basis of a suit filed recently in New York. The hall where the wedding was held was insufficiently heated, the complainants charged, and hence they had caught cold!

**T**WO athletic young people of my acquaintance, a brother and sister who live near the seashore, seldom miss their morning "dip" in the icy surf, even on the coldest days of winter. When the snow is on the ground, they run down to the beach with nothing between them and the wintry blasts but abbreviated woolen bathing suits. Yet these human polar bears, and many others like them, do not seem to complain of stuffy noses any more often than the rest of us.

There is no question, it is true, that exposure may in some cases cause a certain amount of unpleasant stuffiness, if only for a short time. (Continued on page 129)



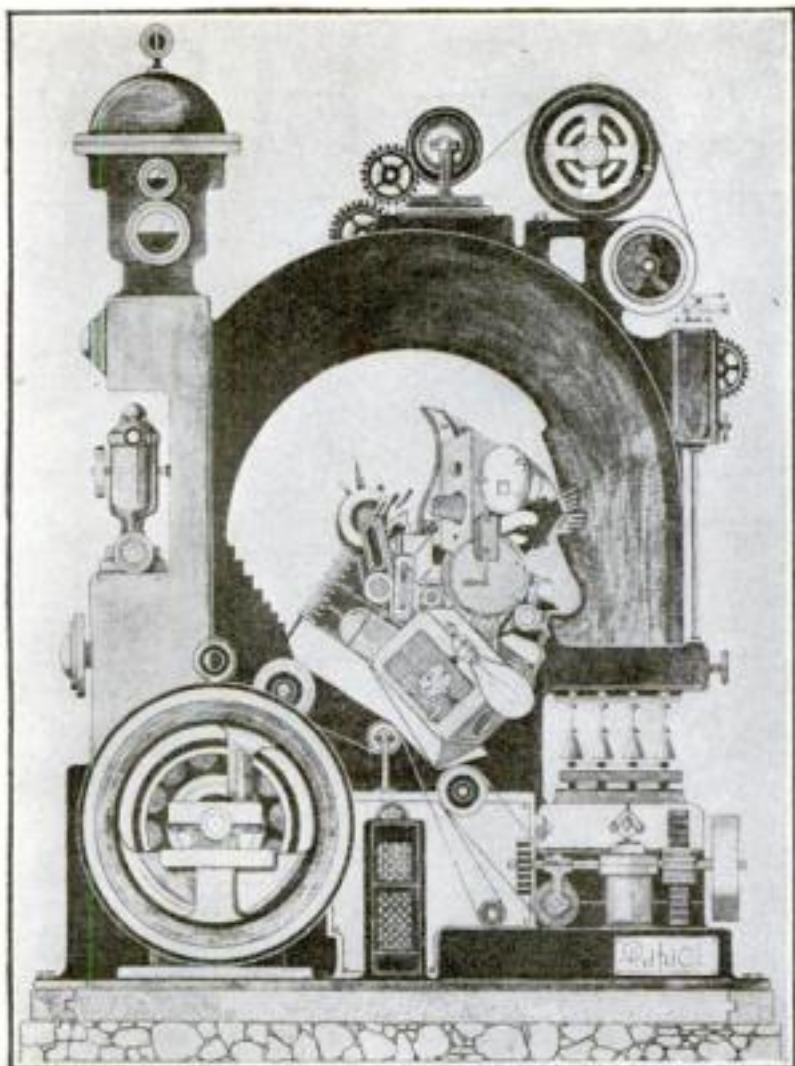
Sweating—a time-honored remedy—is induced effectively by hot lemonade and scorching baths before going to bed at night



# Edison, at 79, Active while World "Catches Up"

*Invents Novel New Phonograph  
Record That Plays Forty Minutes*

By ALDEN P. ARMAGNAC



Courtesy The New York Sun

Thomas A. Edison as he impressed an Argentine artist—this strange portrait being made up entirely of parts of inventions which made the wizard famous

**W**HHEELS and cogs, pumps and dynamos—these were the parts of a remarkable impressionist portrait of Thomas Alva Edison sketched a few weeks ago by Rafael, Argentine artist.

"All mechanical," was Edison's amused comment as he smilingly accepted the artist's gift of the portrait. "No soul." He turned to his secretary, W. H. Meadowcroft. "Hang it up on the wall," he said. Then he returned to work.

Was the artist right? Is this great man a mechanized inventing machine, stripped of ordinary human emotions for the sake of machinelike efficiency? Can his life be summed up by an alphabetical list of the more than 1500 patents that bear his name? I think not.

Thomas A. Edison is not "all machine," despite the terrific concentration that marks his hours in the laboratory. He is a most human individual, and one who thoroughly enjoys life. He has a delightful fund of dry humor.

Recently, for example, the great inventor was reported by an interviewer to be working on a loudspeaker for the receiving of "spirit messages." For a long time Edison evaded answering questions about it. At length he told the story.

"That man," a friend quotes him as saying, "came to see me on one of the coldest days of the year. His nose was blue and his teeth were chattering. I really had nothing to tell him, but I

hated to disappoint him, so I made up the story about communicating with the spirits. It was all a joke."

It is true, however, that Edison fritters away few waking hours in pleasantries. He calls himself 135 years old; for, he says, the average man would take that long to put in as much work as he has done in his seventy-nine years. Day after day, crowded with experiments, finds him in his laboratory fourteen, sixteen and even twenty hours at a stretch.

His unremitting passion for experiment dates back to boyhood. At six years of age, he tried to hatch goose and hen's eggs by sitting on them, after the manner of the mother bird! Later, at ten, he succeeded in persuading one of his chums to swallow quantities of Seidlitz powders, confidently expecting that his boy friend would rise like a balloon and float through the air. The results Edison describes as disappointing to himself and highly distressing to the subject of his experiments.

Eventually he managed to amass something in the nature of a chemical

laboratory. All of his chemical bottles he labeled "Poison," whatever their contents, to insure that they be left alone in his absence. His first laboratory was in his mother's cellar; his second, the empty unventilated smoker of the train on which he sold papers to pay for his experiments. Here he succeeded in setting the train on fire when some phosphorus upset, and in his unceremonious departure he received a box on the ears from the conductor that left his hearing permanently impaired. Edison always took this philosophically, as an unavoidable accident not worth mulling over.

After his meteoric rise into fame, new experiments still occupied first place in his mind. A notoriously poor business man, he understood himself well enough to insist that the \$100,000 he received for his telephone transmitter be paid him in seventeen yearly installments, for the life of the patent. He knew that if he received the entire sum at once, he would spend it all immediately—not on himself, but for research.

**N**EVER satisfied to rest, his mind is always busy with some new problem. The amazing story is told of how Edison never saw the Woolworth building, most striking feature of New York City's skyline, for years, though he passed near it frequently. It is this power of concentration that has enabled him to give mankind inventions which, in their present development, are valued at \$15,000,000,000!

His latest achievement, the forty-minute phonograph record, gives an entire program of dinner music without the need of changing records. In the twelve inches of its diameter there travels a spiral groove as thin as a human hair and a mile and a quarter long. Today, on the eve of his eightieth birthday, he feels that in electricity we are only just beginning; are on the threshold of a wonderful new age—one in which man's hardest work will be done when he pushes a button.



Edison's newest invention, a forty-minute phonograph record, with the special reproducer that must be used with it, is being demonstrated here by Charles Edison (left) son of the inventor, and Arthur L. Walsh, vice-president of the Edison organization



# Automobile Magic — How

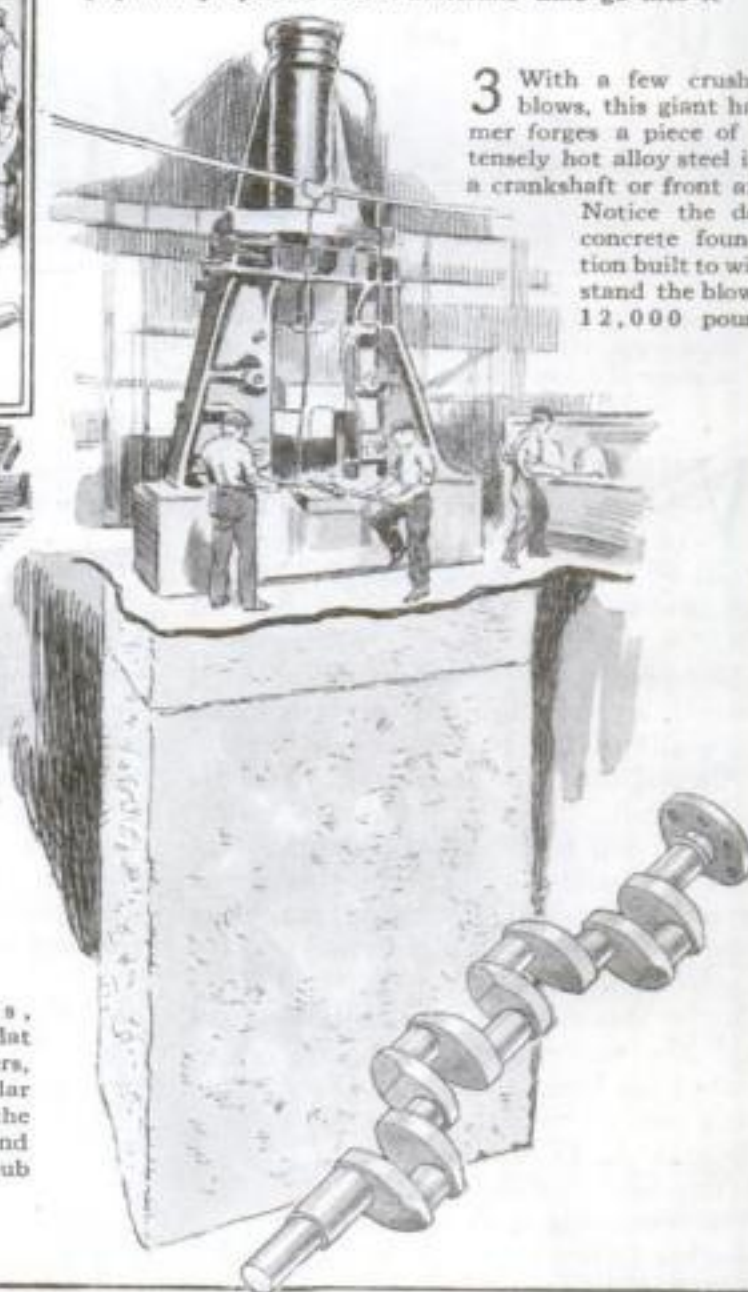
A Picture Story of Mechanical Wonders Inside an Auto Factory, Where Steel Is "Almost Human"

**2** Every motor car is born in the foundry, where white hot molten iron from a cupola furnace (at right) is poured from ladles into casting molds. After cooling, the castings are cleaned with a sand blast, carefully inspected, and transported to the machine shop, where powerful machines, operating almost automatically, do the necessary turning, boring, drilling and grinding

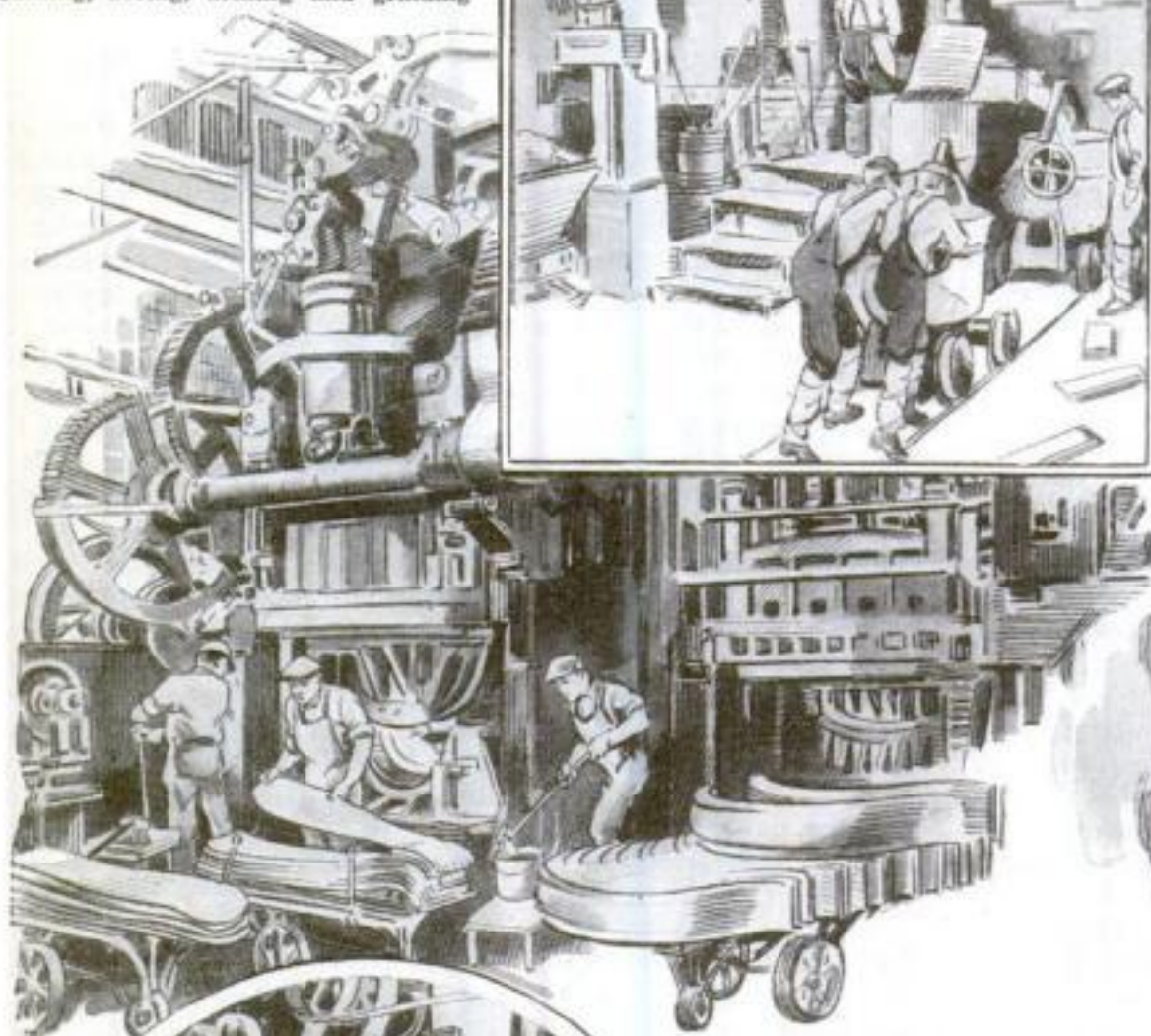


**1** Long life for your car depends, first of all, on careful tests in the chemical and metallurgical laboratories, to check the chemical composition and physical properties of the materials that go into it

**3** With a few crushing blows, this giant hammer forges a piece of intensely hot alloy steel into a crankshaft or front axle. Notice the deep concrete foundation built to withstand the blow of 12,000 pounds

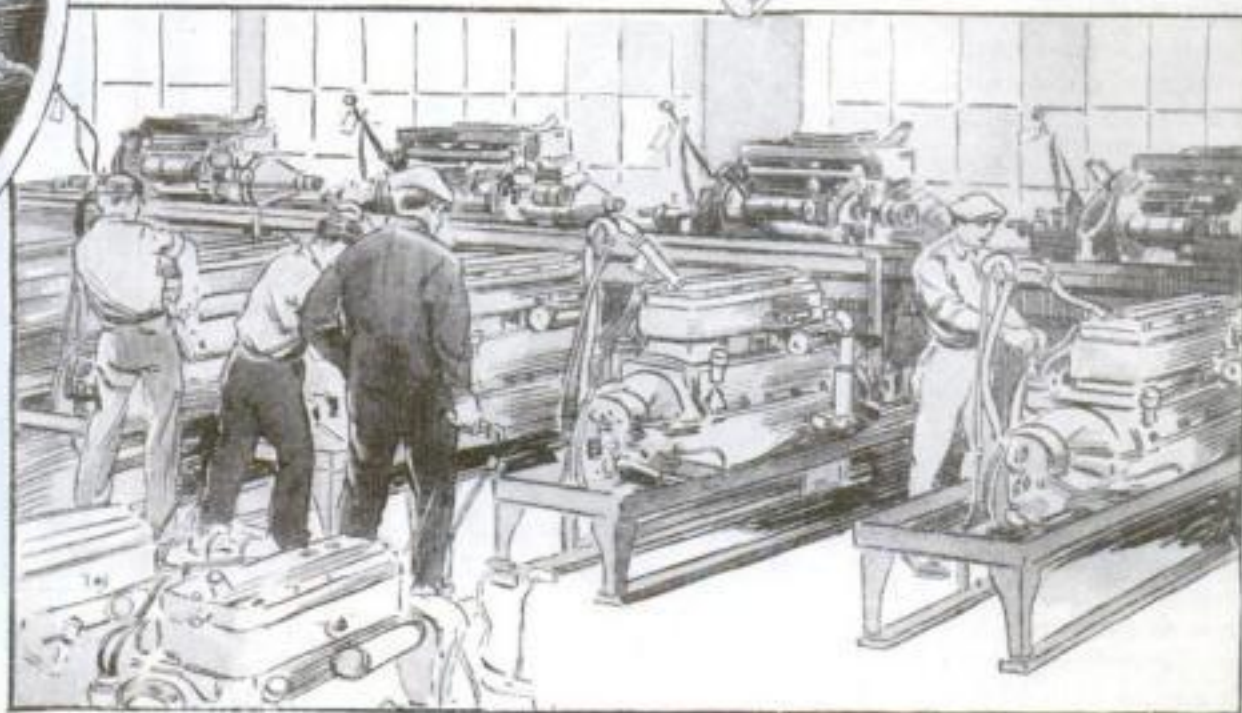


**4** Mammoth presses, shown above, convert flat sheets of steel into fenders, doors, body panels and similar parts. Other presses form the axle housing, brake drums, and even the entire front wheel hub



**5** In fashioning an automobile engine from a casting, all cylinders are bored at once, then polished or honed to fine smoothness. They must be accurate to within one thousandth of an inch. Another machine drills holes for the valve lifters and valves, and finishes the valve seats

**6** The engines next are assembled on moving conveyors, each workman being skilled in quick, accurate performance of one particular operation. Afterward, the finished engines are tested on their own power on special stands

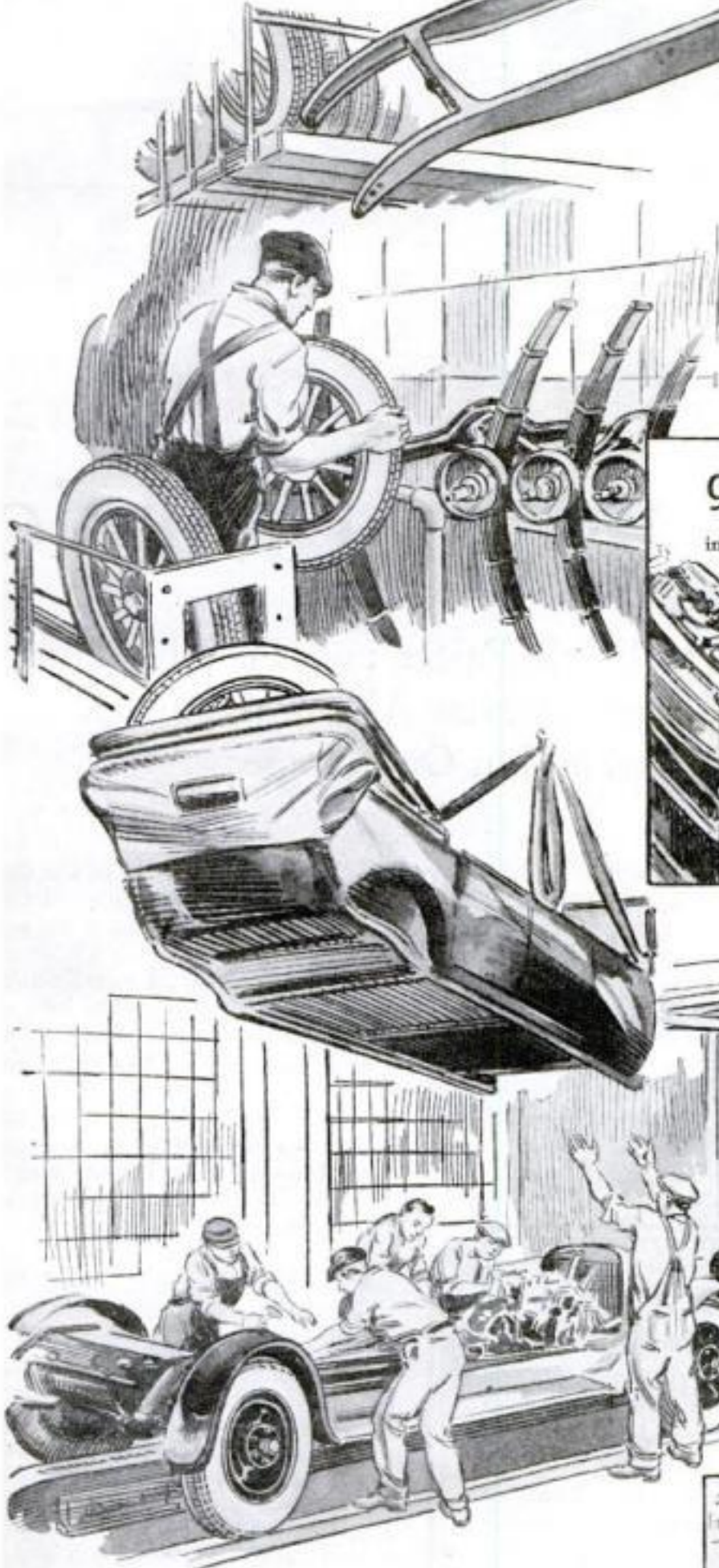


Sketches made in the plant of Dodge Brothers Manufacturing Company by L. U. Rearts



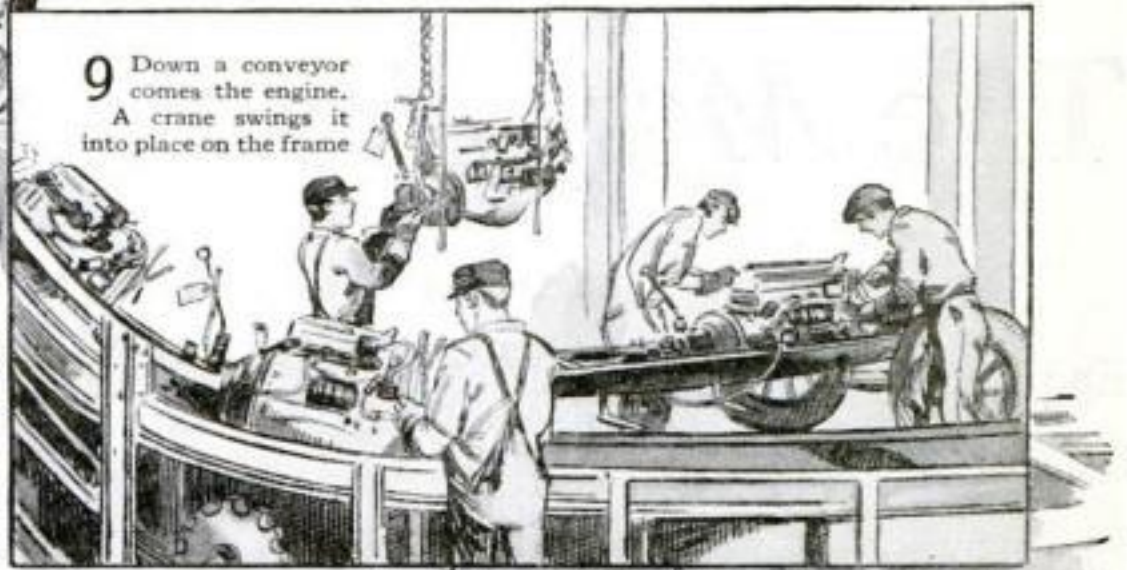
# Your Car Is Built

**8** To the steel frame are bolted the axles, with springs and wheels attached and tires mounted. How these are brought together in the second stage of chassis assembly is pictured below. Notice how the wheels are conveyed to within easy reach of the assembler on an inclined track.



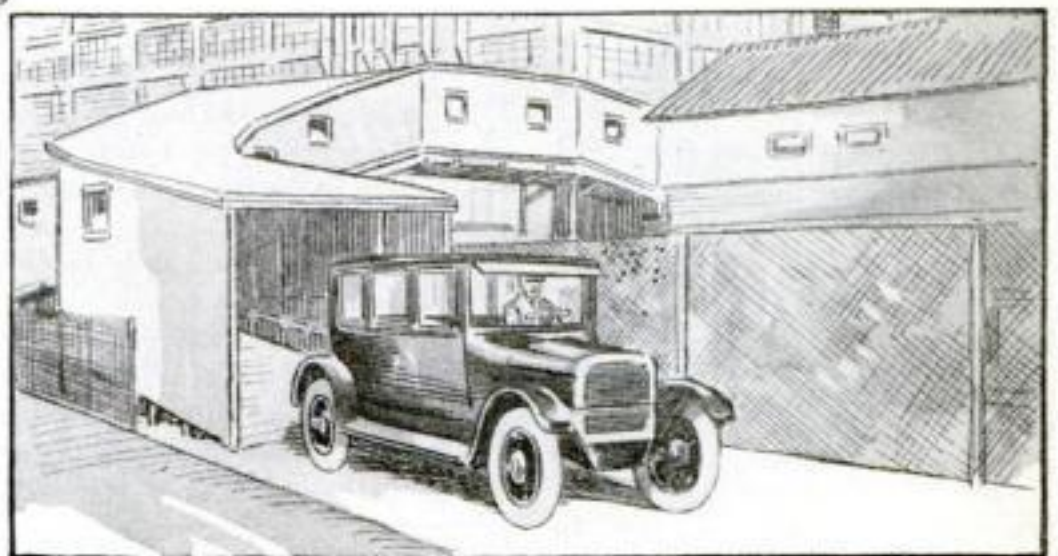
**7** The sturdy pressed steel frame shown at the top of the page is the foundation on which the chassis is built. Workmen are seen here riveting running board brackets to the frame, which then is enameled and baked in an oven.

**9** Down a conveyor comes the engine. A crane swings it into place on the frame.



**10** While the completed chassis move along constantly on assembly conveyors beneath, an overhead monorail conveyor lowers the upholstered bodies upon them through openings in the ceiling. Expert assemblers swiftly and dexterously apply the various parts as the chassis move always forward past them.

**11** Complete except for headlights and license plates, the finished car finally rolls out of the factory under its own power. It is then given a road test on a special track for a final tuning-up and sent out with a clean bill of health, ready for a buyer.







### Under Its Magic Spell

Scientists have found that the same mysterious power which the Hindu snake charmer uses makes us work faster and with less fatigue. In this New Jersey electrical factory the girl operators' fingers fly in rhythm with lively phonograph music.



## *New Things We Are Learning About* **The Mysterious Power of Music**

By  
EDGAR C. WHEELER

We Can Work Harder, Think Faster and Feel Happier  
to Quick-Rhythm Tunes—A New Aid in Hospitals,  
Industrial Plants, and in Our Homes

**A** FEW weeks ago I was visiting at the home of friends, when the hostess suggested playing a few selections on their new phonograph.

"But first," she said, addressing me, "how do you feel?"

"First rate—but why do you ask?" I replied, somewhat astonished.

"Just so I'll know what selections to play! Here, let me show you what I mean," she added, opening the doors of the phonograph cabinet. On each shelf, containing a number of records, she had pasted a little type-written label. The first one I examined read something like this: "Play when life grows too monotonous; stirs you up." I glanced quickly through the records on that shelf. One was the "Toreador Song" from *Carmen*, sung by a baritone and chorus. Another was the "Marseillaise," played by a military band. A third was "Keep the Home Fires Burning."

On the next shelf the label read: "Play when worried; brings you peace of mind." Typical of these records were the "Meditation" from *Thais*, by Massenet, played by Albert Spalding, violinist; "Home, Sweet Home," sung by Anna Case; and a dance orchestra waltz entitled "My Isle of Golden Dreams."

Still other shelves bore classifications such as: "Play to

stimulate new ideas, imagination and invention;" "Play when glum, makes you joyous;" "Play when in wistful mood;" "Play for more energy." Love songs and selections for children had separate shelves.

"Where did you get the idea?" I asked.

"It wasn't my idea. A musician friend showed me how to select the records and classify them. You may not believe it, but the system works like a charm!

However I may feel at the end of the day—tired, gay, nervous or whatnot—I can always pick out the right music to pep me up or quiet me."

Like most other people, I usually take my music as it comes—good, bad or indifferent. But here was a novel idea. It interested me. The next day I made some inquiries, and I discovered that its originator was none other than the greatest of American inventors, Thomas A. Edison. I found that Edison was a pioneer in the new science of applied music.

### Has It Happened to You?

**H**AVE you ever come home, fagged out at the end of a wracking day, and dropped into a chair with your head so awl that it seems about to fly to pieces? Distractedly, you reach for the radio dials. There comes to you a song, swinging slowly, soothing. Your muscles relax. You find yourself humming. The tune changes—a stirring patrol march. Before you know it you are tapping the floor with your feet. When it is over, somewhere, in the quick, rhythmic strains, your troubles have vanished.

Though we are only beginning to understand this mysterious power, already, as Mr. Wheeler tells, amazing examples of its utilization are found. Hospitals, industrial plants and men as individuals are choosing and using music today on the basis of its astounding and scientifically proved effects.

**A** FEW years ago, when the new marvels of multiplying music by radio, talking machines and piano players were placing the best artists in our homes, Edison came to the conclusion that this great mass of unassorted music should be sorted out scientifically and put to intelligent use. People, he thought, would welcome some guide for choosing the kind of music that would meet their mental, physical and emotional needs from day to day. He engaged the services of a leading authority on applied psychology, Dr. Walter V. Bingham, then associated with the Carnegie Institute of Technology. With a number of associates, Dr. Bingham undertook a series of remarkable tests.

Taking 589 different musical



selections, varying all the way from jazz to grand opera, they tried these out on various listeners, all of whom were experienced in self-analysis. The listening conditions were carefully regulated, and all changes in moods and feelings of the listeners recorded. The tests lasted several months.

Some of the results were surprising. For example, a number of hymns, instead of creating a mood of reverence, were found to induce a decidedly frivolous gaiety. A few pieces, too, varied extremely in the way they affected different listeners. But in the end the experimenters were able to classify 135 selections which produced unmistakable and marked effects, mentally and emotionally, on all who heard them. This was the list which had guided my friend.

**N**OT long ago two educators at Columbia University demonstrated in another striking way the ability of music to produce moods to order. They were Prof. Charles Hubert Farnsworth, musician, and Prof. Alon Bement, artist, and the tests were made on students of Professor Bement's class in sketching. While a series of musical selections were played, the students were asked to draw rapidly any designs which came to mind. Titles or composers of the compositions were not announced. When the drawings were collected, it was found an easy matter to distinguish those which were sketched while a jazz piece was played, those drawn to the tune of the "Moonlight Sonata," and those sketched to Sousa's "Stars and Stripes Forever." No two of the drawings were alike in subject, yet each reflected unmistakably the mood created by the music.

How the blood-stirring strains of bagpipes have incited Scotch kilties to reckless fury in battle is a matter of history. Our own overseas vets know how the rhythm of fife and drum can impart new strength to weary soldiers on the march. Henry T. Finck, music critic, once declared that listening to a concert enabled him to sketch the plan for an entire book.

Most of us who enjoy music have felt its mysterious power to sway us—to rest us when we are tired, make us happy when we are glum, stimulate our imag-

inations, encourage us, thrill and inspire us. But just what is this strange power? Why do we tap our feet to the rhythm of a lively tune, and how is it that a blast of music from a great orchestra can send chills racing down our spines? Why does one kind of music make us "feel good," another depress us?

Scientists are just beginning to learn the answers. Within recent years they have learned that music, besides being a source of pleasure and entertainment, can become a force of immense practical value in our homes, offices and workshops; that melodies and harmonies, chosen and used scientifically, possess remarkable powers of renewing our vitality.

The secret of music's power, they generally agree, is its rhythm. This rhythm, impressed upon you through your ears, goes through your body with contagious effect, just as the footfalls of marching soldiers will cause a bridge to sway if the soldiers keep in step.

**N**EARLY all of your bodily machinery operates rhythmically. The rhythm of music seems to have the effect of altering the beat of this natural rhythm. It arouses or depresses the action of your nerves, changes the action of your bodily secretions, makes your heart beat faster or slower, alters the rhythm of your breathing, and acts through motor nerves on your muscles.

Your pulse rate, in addition, directly influences your reaction to lively or sad music, for the effect of any musical selection depends largely on the relation of the speed of rhythm to the speed of your heartbeats. The average normal human pulse runs about seventy beats to the minute. A lively tune, like a quick-step march, the rhythm of which is faster than the heartbeat—say eighty to the



### Practicing Penmanship to Music

Music directly affects our muscular endurance, tests show. Keeping rhythmic time to the music of foxtrot and one-step phonograph records, these pupils of an Eastern school find penmanship a fascinating exercise

minute—almost always has the effect of exciting or exhilarating us. We express our reaction to this excitement by tapping with our feet and applauding. On the other hand, music with rhythm slower than the heartbeat has opposite effects. Sometimes it rests us; often it depresses and makes us gloomy.

This explains, too, why in moments of high excitement, quick-rhythm music may sweep us completely off our feet and why, similarly, in moments of depression, slow music may sink us to despair.

Franz Kneisel, late leader of the famous Kneisel string quartet, took advantage of these facts by deliberately setting the rhythm of his selections slightly above the normal heartbeat. The result of this was invariably a marked increase in applause. Moreover, he made use of the fact that the weather influences the human pulse rate. On the morning before an important concert he would study the weather forecast and arrange the rhythmic speed of his musical selections accordingly.

**T**HE secret of the popularity of John Philip Sousa, the famous bandmaster, it has been said, lay partly in the fact that he usually timed the rhythm of his band music just above that of the normal heartbeat.

Dr. E. E. Free, authority on sound and light, learned some interesting facts about our foot-tapping habits in recent experiments with theater audiences. During a slow musical number, a stethoscope detected considerable tapping of feet at the outset, but this quickly died out. During a lively selection, the tapping began softly and steadily increased, until finally at least ninety percent of the audience were beating time with their feet. Which suggests the question: Why do we use our feet instead of our heads, arms, or bodies, to beat time? A few weeks ago a Swiss scientist advanced the novel theory that the nerves which first react to music are centered in the feet. The accepted explanation, however, is simply that our feet are the most convenient members to move, especially when we are seated.

To demonstrate to yourself the importance of rhythm in the effect of music, select some slow-moving (Continued on page 130)

### When Movie Actors Need Music

Movie actors would find love scenes difficult to do without musical accompaniment. Two musicians played melodies of love for Pauline Starke and Conrad Nagel during this scene from "Sun Up"



Courtesy  
Metro-Goldwyn



# Home Owners Report Remarkable OIL BURNER Results

*Nation-Wide Survey by Popular Science Institute of Standards Shows None Willing to Go Back to Coal*

**I**N LINE with its aim to give the readers of POPULAR SCIENCE MONTHLY maximum service, the Popular Science Institute of Standards recently undertook the most comprehensive investigation of oil burners that has yet been made. Investigators have gone into nearly 1500 homes in widely scattered sections, where oil burners are actually in operation, to determine the comparative value of various makes of oil burners in relation to each other and to the coal-fired furnace.

As this is being written, preliminary reports covering a large part of the East, Middle West and Pacific coast sections of the country have been tabulated. Both large and small towns in representative communities of home owners have been studied. Amazing facts already have been brought out in this country-wide investigation.

The Institute's investigators gathered information without prejudice or bias. They were after the cold, hard facts of oil burner operation from the viewpoint of the owner; consequently, it is possible to draw definite conclusions from their reports as to what you may expect from an oil burner installed in your own home. The table on this page shows what the investigators have found out so far.

Undoubtedly the most astounding feature of the investigation is that up to date the men who are making it have been unable to find a single owner of an oil burner who could be induced to go back to a coal fire to heat his home. Out of 1247 home owners, not one would go back to coal—and this despite the fact that many of the owners have had trouble with their oil burners at some time or other, as indicated by the number of service calls tabulated in the list. Evidently the most unsatisfactory oil burner gives more uniform heat and less trouble than a coal fire when it is working at its best!

**T**HE tabulation shows 161 dissatisfied oil burner owners. This amounts, roughly, to one out of eight of the people investigated.

In all cases, however, it must be remembered, "satisfaction" depended on the viewpoint of the individual owner. One owner, for instance, might say that he was perfectly satisfied with his oil burner although he may have had occasion to call for service several times during the winter. Others were dissatisfied when by their own admission they had had only one service call in more than a year. And al-

though it is generally agreed that atmospheric oil burners cannot give the highly perfected heating service obtainable from the more expensive mechanical draft types, it is interesting to note that a normal percentage of atmospheric burner owners reported complete satisfaction.



## What the Survey Shows

Total number of burner installations investigated . . .	1247
Satisfied owners . . . . .	1086
Total years of service for burners investigated . . . . .	3055
Total service calls for these years of service . . . . .	2212
Owners reporting unsatisfactory service . . . . .	97
Owners not disturbed by noise . . . . .	1149
Noise objectionable . . . . .	98
Operating cost more than coal . . . . .	258
Owners willing to shift back to coal . . . . .	NONE

They had not expected too much!

The heating comfort that any oil burner can give depends first on the ability of the burner to operate perfectly over long periods of time without attention; and, second, on how quickly the local representative of the oil burner manufacturer gets on the job and fixes things when a breakdown does occur.

The investigation is bringing out some startling facts along these lines. The 1247 burners examined so far have been in use a total of 3055 years. This is equivalent to the continuous operation of one oil burner since before King Solomon built the Temple of Jerusalem! And in that vast total of years of heating comfort there have been only 2212 calls for service. This approximates only one call for each sixteen and one half months of operation; not a bad record, especially when we consider that it includes large numbers of trouble calls that were caused by oil tanks unexpectedly running dry and similar difficulties for which the oil burning equipment certainly was not to blame.

Only ninety-seven owners reported unsatisfactory service. This speaks well for the care with which the manufacturers of

oil burners have built up their organizations of representatives, and it emphasizes the importance of buying your oil burner from a reliable dealer who is competent to give you quick and satisfactory service if anything should go wrong.

In fact, the experiences of users of one particular make of oil burner show what superlatively fine service can do to keep customers satisfied. Although this burner heads the list for number of service calls required and trouble from unreliable operation, each owner reported that the service organization seemed to be prepared to go to almost any lengths to keep the burners in constant operation. Trouble calls at any hour of the day or night have been taken care of immediately. Consequently, a far larger percentage of these owners are satisfied than would have been the case if the service had been below average.

**A** GREAT many readers have written in to POPULAR SCIENCE MONTHLY for information about the noise produced by the mechanical draft type of oil burner. They have heard, or are under the impression, that oil burners are noisy. That idea is not substantiated by the results of the investigation. Less than eight percent of the owners of oil burners reported that the noise is objectionable. This small percentage included a number of installations, so the investigators report, which had been made under conditions where the slight noise produced by the burner was magnified by the peculiar construction or arrangement of the house.

The majority of oil burner owners reported that the cost of operation was equal to or less than when coal had been used. A fair number reported an increase in cost compared with coal, but in nearly every case where an increase was reported, the owner agreed that the increase was more than made up for by the additional heating comfort that the oil burner gave him. In many instances it was found that the extra cost was because the house was now kept at a comfortable temperature all day long, whereas when coal had been used the house was cold much of the time because of the attention required by a coal fire.

The Popular Science Institute of Standards is at your service to help you solve your heating problems. For information and advice about oil-burning equipment for your home, write to the Popular Science Institute of Standards, 250 Fourth Avenue, New York City.



# He *SPEEDED UP* the WORLD

*The Story of a Boy's Fight for His Idea  
Against the Greatest Railroad  
Minds of His Time*

By H. C. NORTH

A LOCOMOTIVE whistle shrieked in sharp warning. Brakes grated, smoked and groaned. Coaches jostled each other angrily, straining at their couplings, threatening to break from line and stampede across the fields. Puffing, balking, trembling, the train came slowly and haltingly to a full stop.

The passengers, thoroughly disheveled by the prolonged shaking, rushed to the doors and poured down the steps. Wrecks and derailment were not uncommon in 1866; fatalities were numerous; the sooner one got out of a train that had stopped where it wasn't scheduled to stop, the better. A few yards ahead, the shaken passengers saw the cause of their bruises.

On the track before them sprawled what was left of two heavily-laden freight trains. The locomotives, twisted and crumbled hulks, lay like two huge beasts that had torn at each other until death had come to both. Freight cars littered the track behind each combatant, crushed, upended, distorted. From their broken sides the cars had spewed their cargo over the roadbed and down the embankment. A crew of men was already at work clearing away the ruin.

"What happened?" "How did it happen?" "Anybody hurt?" The foreman of the emergency crew was besieged with a hundred questions.

"Head-on collision," was the laconic reply which seemed to satisfy all comers, and they returned to their coaches to await a clear track.

"The engineers must have been drunk or asleep," remarked a dark-haired, athletically built young man, his thoughtful eyes professionally scanning the wreckage.

The foreman spat and winked wisely.

"Couldn't stop," he barked.

"Didn't the brakes work?"

"Sure, they *worked*," he said impatiently, "but they didn't work fast enough. It takes *time* to stop a train." And he turned with an air of superior knowledge to his men, muttering something about greenhorns.

IT HAS been said of George Westinghouse that all his inventions were made to fill some particular need; that his constant watchfulness pointed those needs out to him. And now, instead of fretting about the delay of his train, he puzzled

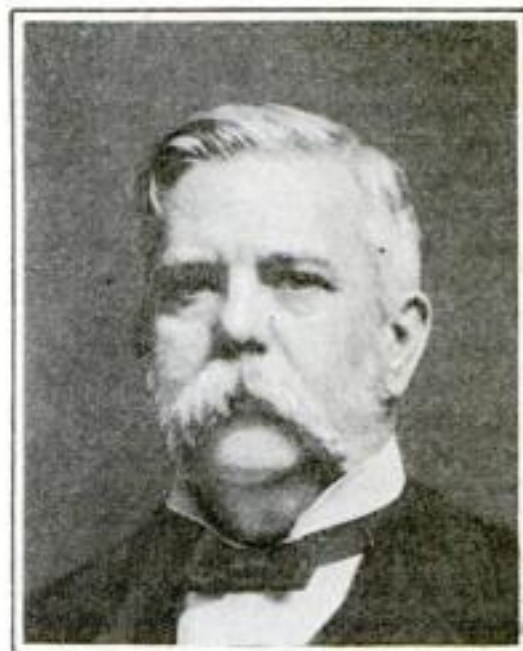


To a Chance Act  
of Kindness

Perhaps no great invention ever had as strange a beginning as young Westinghouse's. He owed his success to the gentle eyes of a girl he saw only once in his life

over the problem which the accident and the foreman's words had brought to his attention. Why should it take so long to stop a train? The engineers had been alert; but, in order to avoid a crash, with the clumsy system of brakes then in use, they would have had to start applying them when a full mile from each other. Obviously, transportation would never be safe or efficient until a more practical brake was evolved.

HAND braking, at the time young Westinghouse had its dangers so graphically presented, was laborious as well as hazardous. One brakeman was stationed between every two cars. On a passenger train, when about a half mile from the stopping point, each brakeman would start to turn a wheel on the platform of one of the cars. This slowly tightened a chain which operated the brakes on a single pair of wheels. When the brakes were set, he would repeat his task on the wheel on the opposite platform. The work was dangerous and the result unsatisfactory, for it was impossible to brake the cars with any uniformity and avoid bumping them together. On freight trains the danger was even greater. The brakemen rode on the tops of the cars, where they were exposed to



"IT TAKES time to stop a train," a foreman impatiently explained to young George Westinghouse in 1866. Wrecks were frequent and travel slow. All his life Westinghouse saw particular needs which inventive genius could meet. The result of the foreman's remark was a series of inventions that revolutionized railroad transportation

being swept off or to falling between the trucks.

To Westinghouse, it seemed that the wreck he now viewed could have been avoided easily if the engineers had had direct control over the brakes. It was upon a mechanism which would set the brakes of every car of a train simultaneously that he next turned his mind.

Though only nineteen years of age at the time, he was not unfamiliar with transportation. He was already the inventor of a car replacer—a cast steel frog for replacing derailed trains—which also had been suggested by an accident. His invention had resulted in a partnership with two older men who furnished the capital for manufacturing the product. He traveled for the concern, and was at present journeying to Troy, N. Y., in the interests of the company.

Several ideas for such a brake occurred to him. One was a device which depended for its power upon the coupling-up of the cars when the steam was shut off. He decided it would be impractical because of the weight of the trains. Another idea was the control of all the brakes by means of a chain extending beneath the entire train.

WITH the question still unanswered, he visited Chicago on business. Here, through Superintendent Towne of the Chicago, Burlington & Quincy Railroad, he met the inventor of a brake then in use on that road.

"I, too, am working on a braking mechanism," Westinghouse remarked, as they neared the yards to inspect the invention.

The inventor, who up to that moment had been most affable and talkative, immediately stiffened.



"You're wasting your time, youngster," he said shortly. "I know all there is to be known about brakes, and you will find everything is covered by my patents."

"A broad statement," thought Westinghouse, as he inspected the contrivance.

To his surprise, this invention incorporated his own tentative plan of running a chain the full length of the train underneath the cars. It was operated by a windlass which, when attached to the driving wheel, tightened the chain and applied the brakes. Westinghouse, however, considered the contraption impractical from several standpoints.

**H**IS first improvement would have been to attach the chain to a piston which worked in a cylinder beneath the engine. With steam from the boiler, the piston could be manipulated to tighten the chain nicely and smoothly. But he soon realized that no engine could carry a cylinder sufficiently large to operate the brakes on a train of more than a few cars.

It next occurred to him, in his persistent searching for a solution, that each car might be equipped with a cylinder supplied with steam from the engine by pipes running through the cars. But this theory was exploded by the impossibility of transmitting steam from car to car without its condensing. Some other power would have to be employed. What it would be, Westinghouse had not the faintest conception.

As he sat pondering over the seeming hopelessness of his dilemma one noon hour after his partners had gone to lunch, he gradually became aware that someone was standing near him. Jumping up, he gazed into the startled eyes of a girl who had apparently been awaiting his attention for some time.

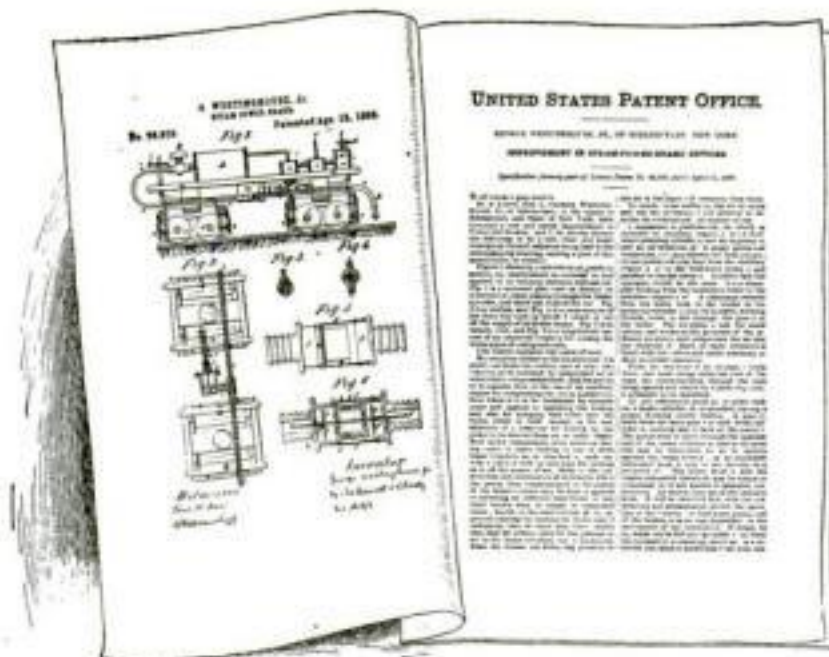
"I am taking subscriptions for the—" she began timidly, extending a magazine which she carried in her hand.

"I don't read magazines," Westinghouse interrupted bluntly, still lost in abstraction and conscious only of the interruption to his train of thought.

"**B**UT, if you—" she faltered, only to meet Westinghouse's mechanically uttered, "Try somebody else."

"I have," she said, so faintly that Westinghouse again turned to her and for the first time really saw her.

He found himself looking into pleading blue eyes, gentle and intelligent, which struggled bravely to suppress tears of discouragement. He was vaguely conscious



#### Westinghouse's Basic Patent

Above is a reproduction of the first and basic Westinghouse air brake patent, issued April 13, 1869. This first patent drawing represents the high point of the Westinghouse contribution, though other patents along the same lines, of nearly equal importance, were granted later

that her hair was soft, and that it curled about a face that was fair. His face softened.

"Start my subscription with this number," said Westinghouse, reaching into his pocket and handing her a bill.

The girl departed, never to be seen by Westinghouse again. Who she was, he never discovered. Yet to her blue eyes and gentle manner he was to be indebted the rest of his life.

The magazine arrived and remained unread for days, while Westinghouse busied himself with other matters. Then, one night, he picked the thing up and thumbed idly through it. An article, "In the Mont Cenis Tunnel," attracted his attention. He dipped into it, found the long descriptive introduction tedious, noted without interest that the country was beautiful, turned another page before

laying it down. He read that page.

The engineers in charge of boring this tunnel in Italy had been forced to abandon steam drills in their work, because the fire needed to generate the steam consumed the air in the shaft. Finally, after experimentation, they had adopted compressed air to drive their drills. It did the work and furnished air for the workmen as well.

**F**OR a second Westinghouse sat frigid. Then with a shout he tossed the magazine into the air, sprang to his feet, and paced excitedly about the room.

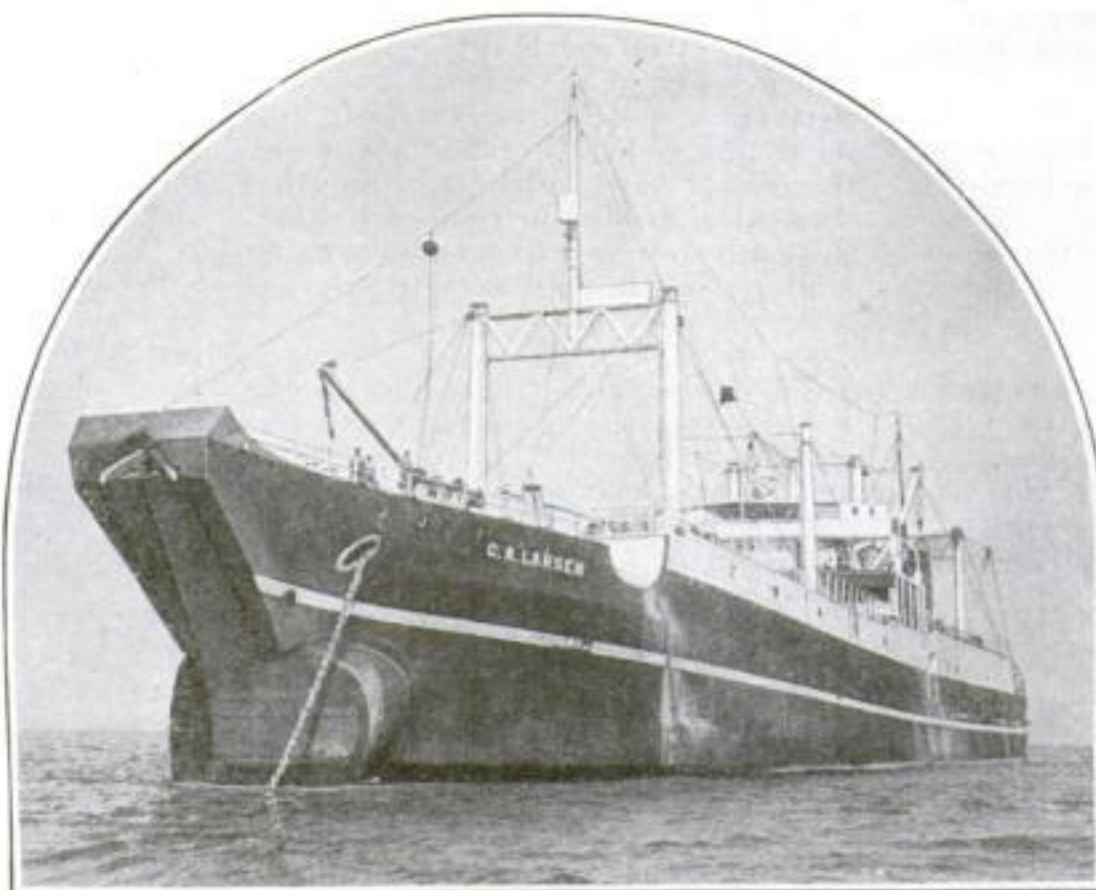
"It'll work. It'll work," he repeated over and over. "If compressed air can drive a drill through mountains, after being conveyed through thousands of feet of pipe, it can apply the brakes on the longest train that was ever made."

There was little sleep for him that night. The next morning he was frantically at work on drawings of the invention which was to revolutionize transportation throughout the world.

But discouragement seems ever to tread on the heels of triumph. It was only a few days after this that his partners approached him with grave faces and announced that they had serious business to discuss with him. With sinking heart, young Westinghouse followed the two older men into the office and, taking his accustomed seat by the window, gazed miserably out into the downpour of rain. There was a moment's silence. Then, after a few awkward remarks, one of the partners addressed the boy.

"As you know," he began pointedly, "our business is almost at a standstill. The sales have decreased until we are barely earning a living."

### When This Ship Yawns, It Swallows Whales!



**I**N THE bow of this gigantic California whaler is a huge door that opens wide to receive one of the mammoths of the deep. Water-sealed, it can be swung wide to bring the whale into the hold, where complete machinery for cutting up the huge animal is located. The ship shown, the *C. A. Larsen*, is one of the biggest of these new whalers afloat

**W**ESTINGHOUSE continued to study the grayness outside. The two older partners exchanged glances. There was nothing to fear; they were dealing with a boy, after all. George stirred nervously.

"The sales have decreased through no fault of mine—nor of the replacer," he replied moodily. "Because the frog is made of cast steel, it holds up so well that the railroads seldom reorder."

"Exactly what we were talking over before you came in," and again the older partners' eyes met.

"And you suggest?" asked George, growing suspicious.

"Well, our profits are too small to split three ways. We suggest that you buy us out."

(Continued on page 132)





### Proposes Thirteen-Month Year

Prof. Charles F. Marvin, director of the U. S. Weather Bureau, who proposes to divide the year into thirteen months of twenty-eight days each. Every month would begin on Sunday and end on Saturday, as at the right. Between December 28 and January 1 an extra day would be tucked in

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

By FRANK PARKER STOCKBRIDGE

**G**EORGE WASHINGTON was born on February 22, 1732. Thirty days hath September, April, June and November.

What's wrong with those statements? Every schoolboy knows they are correct. But—

The first one is all wrong, and the second will be wrong within a few years, unless the present world-wide movement for calendar reform breaks down from some unforeseeable reason.

George Washington was born on February 11th in the civil year 1731. Otherwise the accepted date of his birth is correct. In my own boyhood we were taught both dates; one was "Old Style" and the other and currently celebrated one was "New Style." And the reason for the difference is that in the year 1752 there came a drastic revision in the Christian calendar; in that year September had only nineteen days in England and the British colonies of America.

That was a funny year, 1752; it was only eight months and twenty-five days long. There was almost as curious a situation in 1923 in Russia and the Balkan states; that year had only 351 days instead of the regular 365 in the countries where the Greek Catholic Church is the state religion, for the heads of that church changed their calendar in 1923 for the first time since it was established by Julius Caesar in the year 46 B.C.

**T**HAT was the first tangible result of the current movement for calendar reform. What the next will be nobody can forecast accurately. It may be the adoption of the plan proposed by Professor Charles F. Marvin, director of the United States Weather Bureau, to divide the year into thirteen months of twenty-

eight days each, every month beginning on a Sunday and ending on a Saturday, with an extra day tucked in as a general holiday between December 28th and January 1st, and two extra days in leap years. That would be a simple and easily remembered calendar, one that would meet the demands of astronomers and statisticians for more accurate standards of comparison from year to year and month to month. But it isn't entirely satisfactory to the business and religious organizations in Europe and America who are cooperating under the direction of the League of Nations in the effort to find a solution which will near please everybody.

**I**T IS certain that we're going to have, within the next half-century, perhaps sooner, a brand-new calendar by which to make our engagements, compute our statistics, plan our business programs with reference to seasonal matters like crop harvests and the market for Easter finery, and calculate the dates of coming religious festivals much more easily and accurately than we can do now.

The trouble with the calendar—all calendars including the Chinese, Mohammedan, Jewish and Gregorian—is that the solar system cannot be induced to run on a mathematical schedule. It runs slow at some seasons and fast at others; some years are longer than others and the length of the year is constantly changing. So is the attitude of the earth in space. The North Pole is tilting gradually away from the direction of Polaris toward Vega, which will be the pole star by the year 13,600 A.D. It takes the earth 365 days, five hours, forty-eight minutes and twenty seconds to make a circuit around the sun, while the rest of the solar system

# Wanted— A Brand-New CALENDAR

*Why George Washington Had  
Two Birthdays, and Why the  
World's Dates Need Fixing*

takes twenty minutes longer to cover the same course. But the really troublesome factor is the moon, which revolves around the earth in 29.53059 days. Since earliest times the circuit of the moon (the month) has been made a basis for calendar building; yet its pace bears no determinable ratio to the earth's revolution around the sun (the year) nor to the rotation of the earth on its own axis (the day)—the two other considerations in calendar building.

Every primitive calendar was based almost exclusively on the moon. The Jewish and Mohammedan calendars, by which probably a majority of human beings order their affairs today, are still on a lunar basis. All of the Christian churches fix the date of their principal festival, Easter, by the moon; it is the Sunday following the first full moon after the vernal equinox. The normal date of the latter is March 21st. It is the day on which the sun crosses the equator on its way north, heralding the approach of spring for the northern world. Easter may fall anywhere from March 22nd to April 25th. If the moon and the religious significance attaching to its phases could be left out of consideration, making a calendar which would satisfy everybody would be easy enough. But the computation of a schedule which will reconcile the surplus of ten days and a fraction left after deducting twelve lunar months from the solar year, with the five hours, forty-eight minutes and twenty seconds left over after 365 days have been accounted for in the year, is a mathematical task at which the greatest astronomers balk. They don't even agree on the length of the solar year; some authorities figure the odd seconds as forty-six instead of twenty!

**T**HE approach of the League of Nations to the problem of calendar reform, therefore, starts with the proposal to establish fixed dates for Easter and the Jewish and Mohammedan festivals which now depend upon the moon's phases. Eliminate the moon, and a calendar which would be practically perfect for at least 20,000 years ahead would be a comparatively simple task.

That is what Julius Caesar set out to do in 46 B.C. The old Romans had a fearfully complicated calendar. Everything



was dated from the founding of the city of Rome, *ab urbe condita*. It was twelve months, alternating twenty-nine and thirty days. That made a 354-day year; but the Romans believed odd numbers are lucky, so they stuck on an extra day solely to make an odd number. So far as the moon was concerned, it was a workable calendar, but there were ten extra days a year to be taken care of, so every second year they tacked in an extra month between the 23rd and 24th of February. This extra month was either twenty-two or twenty-three days long and more than took up the slack. The average year thus became  $366\frac{1}{4}$  days long, or about a day longer than the Solar year. To remedy this, in every third eight-year period they put in only three of the extra months instead of the normal four. Thus they reduced the average length of the year over a twenty-four year period to  $365\frac{1}{4}$  days, which was hitting pretty close to the astronomical facts. This calendar, though, proved too complicated for practical use.

**I**N ALEXANDRIA, Julius Caesar met an Egyptian astronomer named Sosigenes. Sosigenes had computed the length of the tropical year—that is, the time between one vernal equinox and the next, at  $365\frac{1}{4}$  days, the very figure which the Romans had reached by juggling months. Caesar engaged him to work out a calendar the ordinary man could understand. The result was the original Julian calendar and the invention of leap year.

The Julian year had 365 days, arranged in alternate months of thirty and thirty-one days, with one short month, February, having twenty-nine days ordinarily and thirty every fourth year, to take up that odd quarter of a day which Sosigenes had figured out from the stars.

The months corresponding to our present January, March, May, July, September and November were the 31-day months; the others had thirty days.

Julius changed the date of New Year from the vernal equinox, in March, to the first day of January, but kept the names of all the old months except one. That is why we still call the ninth, tenth, eleventh and twelfth months by names which indicate that they are the seventh, eighth, ninth and tenth. September was the seventh month when March was the first, and so on. But the fifth month, which they had called Quintilis, or Fifth, Julius Caesar named after himself, July. And that started a lot of the trouble we've been having with calendars since. For Augustus Caesar, in 26 B.C., insisted upon having a month named after himself, too, and picked Sextilis, which he changed to August. He insisted too upon having his month just as long as

Julius's. To do this he took a day off February and tacked it to August. But that made three thirty-one day months in a row—July, August and September, so he shifted a couple more days, from September and November to October and December. And ever since the children have had to learn to recite the "Thirty days hath September" ditty.



Calendar Stone of Ancient America

The ancient people of America, like the Egyptians, had astronomers and knew much about calendars. Here is a calendar stone found among the ruins of their civilization. Its hieroglyphics, recently deciphered, reveal that they reached practically the same figure for the true length of the year that we have today

The Julian calendar as muddled by Augustus worked along fairly well, however, for sixteen hundred years, except that the common people insisted on calling the vernal equinox New Year's Day and calculating their festivals by the moon; so much so that the Fathers of the Christian church at last officially established the date of the equinox as New Year's and the base from which to calculate the date of Easter. In Caesar's time the equinox fell on March 25th. Then in the eighth century A.D. it was discovered that the equinox and the calendar no longer tallied; the sun was crossing the equator a day earlier every hundred years or so.

**POPE SIXTUS IV**, in 1474, called in Regiomontanus, the most famous astronomer of his time, to discover what was the matter. He died before he got the answer. It was not until more than a hundred years later that men of science were able to tell Pope Gregory XIII that

Sosigenes's calculation of the length of the year had been eleven minutes and fourteen seconds too long, and that this figured out to practically three whole days every four hundred years. The remedy was the simple one of dropping three leap years in every four centuries. Gregory issued a Papal brief, in March, 1582, ordering that thereafter years ending in two ciphers should not be leap years unless their numbers were divisible by 400. The year 1600 was a leap year, but 1700, 1800 and 1900 were not; 2000 will be. In addition to that, however, he directed that the year 1582 should be shortened ten days, by dropping all dates between October 4th and 15th, and that the Julian New Year, January first, should be counted as the beginning of the year. This restored the date of the vernal equinox to March 21st.

**T**HE new calendar went into immediate effect in every Roman Catholic country. The Greek Catholic church, dominating Eastern Europe and all Russia, would have nothing to do with it. Neither would the Protestant states of Germany for a great many years. Scotland, then a Catholic independent nation, adopted the Gregorian calendar, and the Scottish year 1600 began on January first, but England stuck to the Julian calendar until 1752. As the year 1700 was a leap year in the Julian calendar but not in the Gregorian, the difference between the two was, by that time, eleven days. By an act of Parliament, eleven days were dropped from September in that year; the day following September 2 was designated as September 14. At the same time the year 1752 was further shortened, to eight months and twenty-five days, by the designation of the following January first, instead of March 25th, as the official beginning of the new year. Old documents executed in the period between January 1 and March 25, 1753, frequently bear both dates, old style and new style, as "February 11/22, 1752/53."

**WHICH** explains why the birthday of George Washington, then twenty-one years old, may be written either as February 11, 1731 (old style), or February 22, 1732 (new style). In the strictest sense, the currently celebrated date of Washington's birthday is wrong.

The Gregorian calendar which we use today is calculated to run without change for 3,456 years. Its average year over each 400-year period is between 24 and 25 seconds longer than the actual astronomical year, so that somewhere around the year 5038 A.D. another day will have to be dropped from the calendar to keep the vernal equinox from slipping back to March 20th. If there were no other  
(Cont'd on page 134)

JANUARY				APRIL			
JULY				OCTOBER			
S	M	T	W	T	F	S	
1	2	3	4	5	6		
7	8	9	10	11	12	13	
14	15	16	17	18	19	20	
21	22	23	24	25	26	27	
28	29	30					

FEBRUARY				MAY			
AUGUST				NOVEMBER			
S	M	T	W	T	F	S	
			1	2	3	4	
5	6	7	8	9	10	11	
12	13	14	15	16	17	18	
19	20	21	22	23	24	25	
26	27	28	29	30			

MARCH				JUNE			
SEPTEMBER				DECEMBER			
S	M	T	W	T	F	S	
					1	2	
3	4	5	6	7	8	9	
10	11	12	13	14	15	16	
17	18	19	20	21	22	23	
24	25	26	27	28	29	30	
31							

#### Allows Twenty-Six Business Days Each Month

The "New Era" Calendar devised by Prof. L. A. Grosclaude of Switzerland is highly favored in Europe. It is arranged so that a given date would fall always on the same day of the week every year. The calendar would have 364 regular days in the year, with an extra holiday not shown in the calendar. One of its chief advantages, from a business standpoint, is that every month would have exactly twenty-six business days, exclusive of holidays



# More Picture Prize Winners



## FIRST PRIZE

W. V. Chambers, Swarthmore, Pa., wins the first prize of \$500 in our final John and Mary Picture Contest. "Aside from the pleasure derived," he tells us, "I think I gained a pretty good idea of what not to do in laying out a cellar." Mr. Chambers is an illustrator. His hobbies are radio, tennis and modern literature

## SECOND PRIZE

Herbert Kelcey Gault, Baltimore, Md., winner of the second prize of \$100, shown in the photograph at the right with Mrs. Gault, is a Boy Scoutmaster. Another of his hobbies is "to make something useful out of old junk"

*One Thousand Dollars  
Awarded in Our Final  
John and Mary Contest*



## THIRD PRIZE

"This interesting contest has taught me to study the things about me more intensely," writes W. G. Freund of Newark, N. J., winner of the \$50 third prize. He started at a given point in the picture and worked around it, examining every object. He is a power sub-station operator. His hobby is building and repairing radio sets

## Some of the Other Successful Contestants



All the way from Honolulu comes this photograph of Louis L. Oliveira and his wife, who helped him win a prize. Mr. Oliveira is a coppersmith



"I learned more about furnaces and household electrical equipment than I would have in any other way," says L. W. Ahlgrim, Portland, Ore. (at left). A pointer by trade, he is studying architectural drawing at night

Lester G. Foxwell (at the right), of Mount Vernon, N. Y., found many mistakes by comparing each object in the picture with a correct picture of a similar object. His hobby is model steam engines



At fifteen, R. W. Page is a high school senior at Grand Gorge, N. Y. He spends his spare time building mechanical models, of which this neat little airplane is a sample



Another young winner is Andrew Evans, Jr., sixteen, of Homestead, Pa. With his prize money he expects to purchase tools "to improve my hobby of making things"



Edward S. Crockett, an attorney of Boston, Mass., found that when he studied the contest just before retiring at night, additional mistakes came to him readily the next morning



Radio and electrical experimenting occupy the spare time of Herman L. Russell, a barber living in Lott, Texas. He is twenty-four years old. "The contest was a lesson in observation," he says



Fixing things and making them work right is the favorite pastime of Arthur L. Kaser of Mishawaka, Ind., a writer by occupation. That, he says, is why the Picture Contest strongly appealed to him

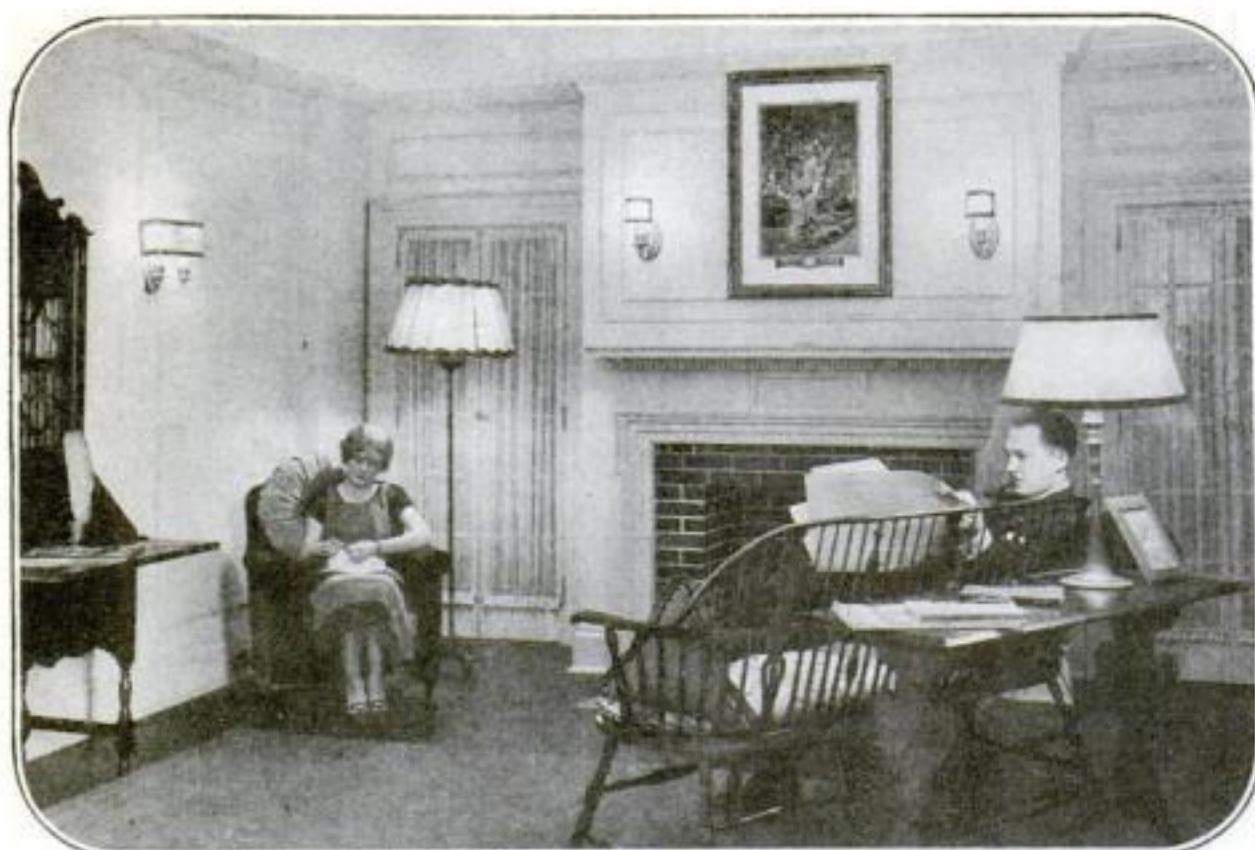


The picture of Mary at work in the laundry especially appealed to Charles A. Garrison, who is a plumber and steam-fitter at Nyack, N. Y.

**TURN** to page 137 for the complete list of prize winners in our final Picture Contest, which appeared last August. And don't miss the fascinating Automobile Contest on page 62 of this issue.



# Is Your Home Lighted for



Photos Edison Lighting Institute, General Electric Co.

A modern well-lighted living room—with the twin enemies, gloom and glare, abolished

"HOW much light do we need for our house?" asked Ellen. "How long is a piece of string?" I countered.

"Do you mean to say," retorted the attractive young woman who is mistress of a brand-new house, "that there is no truth in the claim that lighting has been revolutionized since the days when Abraham Lincoln read books by the flare of a pine knot in the fireplace?"

"Lighting engineers have given us new ideas and inventions, and there has been progress, yes. But there's been no revolution. The glowworm still makes man's best lighting system seem primitive. The human eye is the most wonderful light-adjusting machine we know of."

"That's too mystical for me," grinned Rob. "Here's something more to the point: I have a grievance against our electrical man.

In my absence he went ahead and put in about twice as many electric outlets, with BX cable throughout, as I expected. What in the world am I to do with them all?"

"If he had put in too few outlets and

used knob-and-strip instead of cable, you would have a legitimate cause of complaint," I replied. "As it is, you are lucky he did it. The surplus outlets and cable are no expense beyond the moderate first cost. And you will soon discover the great advantage of plentiful outlets, especially for connecting up your portable lamps; they will no longer be surplus but essential, useful in a dozen ways. With few outlets, people are inclined to have makeshifts of extension cords,



Waist-high electric outlets at convenient points save stooping to connect up lamps or appliances

## ARE YOU PLANNING TO BUILD?

*MR. McMAHON'S services and those of the Popular Science Institute of Standards are available to assist our readers in solving their building problems. Letters will be answered free of charge. Write to the Home Service Department, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York City.*

which are inconvenient and dangerous, though of course useful in homes inadequately wired."

"We have only a few lighting fixtures as yet," said Ellen. "In fact, the house is only about half decorated or papered, though we're living in it."

"So much the better for planning the lighting layout," was my comment. "If you had everything bought and done, it would cost more to change it. I am glad you mentioned decoration and paper, because that is really half the problem of lighting. A gloomy-minded interior decorator can just about completely nullify Edison's chief invention, the incandescent lamp."

"CAN'T you start us off with the A B C's of this lighting subject?" inquired Rob.

"Well, to begin with, the Bureau of Standards at Washington has the basic unit of light, which is termed one candle-

## Points to Watch in Choosing Your Lamps and Fixtures—Don't Stint on Wiring

power. Such a light falling on one square foot of surface at one foot distance is called one foot-candle, and is also termed one lumen. Since light disperses equally in all directions, the total output of one candlepower at one foot distance is 12.57 foot-candles or lumens: that 12.57 being the square-foot area of a sphere of one-foot radius. We are speaking of a central unshaded light.

"The farther from the source the less light, since the same amount spreads over a greater surface. Candlepower divided by distance squared equals the actual illumination you get at that distance.

"It is enough, however, for the average person to have just a glimmering of these fundamentals, in order to read and understand the manufacturer's worked-out tables of illumination."

"Then there are tables for proper lighting, that we could follow?" asked Ellen.

"YES, but the standards are rather offhand and arbitrary. The fact is, man, accustomed to sleeping at night, is still niggardly of artificial illumination and gets along with the least possible. He thinks he is doing well with a 50-watt lamp which at one foot distance has only about one twentieth the intensity of sunlight. He used to worry along with a kerosene lamp of 1/625th the power of sunlight, and before that with a candle equal to 1/10,000th part of sun illumination."

"How many of those light units—lumens—are there in a watt?" asked Rob.

"Eight to ten in the ordinary home

## Two Views of the Same Kitchen,



Note how the housewife is forced to work in her own shadow when the only light comes from a lamp hanging from the ceiling



# Beauty and Comfort?

By JOHN R. McMAHON

lamp. They increase a few as the wattage rises, so that a 100-watt lamp may contain 1300 lumens. It is perhaps more practically important for you to know that heat increases with light power. A 50-watt bulb reaches 262 degrees Fahrenheit, while larger sizes exceed 300 degrees.

"Don't, therefore, touch a high-power lamp with your bare hand, nor cover it with cloth or tissue paper, which might cause a fire by confining the heat. Also, follow the manufacturer's directions for placing high-power lamps—they are aimed to protect socket connections from excessive heat."

"You say there are eight to ten lumens in a watt," remarked Ellen. "To me a watt is such a vague thing—I'm not at all sure I know what you mean."

"YOUR electric light bills will increase your familiarity with the watt family," I laughed. "It is the unit of electrical power. The bills, to be sure, lump one thousand watts into the larger unit of kilowatt or K.W. You must include the time element. A kilowatt for one hour, termed a kilowatt hour, is what you pay for—your bills may read, for instance, eight cents per kilowatt hour. You can figure for yourself exactly what each lamp costs while in use."

"The average home lighting fixture, however, consumes only from one fifth to two fifths of a cent of current an hour."

"Before Ellen pins you down to further practical information," said Rob, "I'd like to know more about the lamp-versus-glowworm question that you started with."

"Well, the best vacuum lamp yields as light only about six percent of the energy it receives. If the worm did no better, I imagine it would have to be as big as an elephant and its wings the size of an airplane's, to give the same tiny glow. A

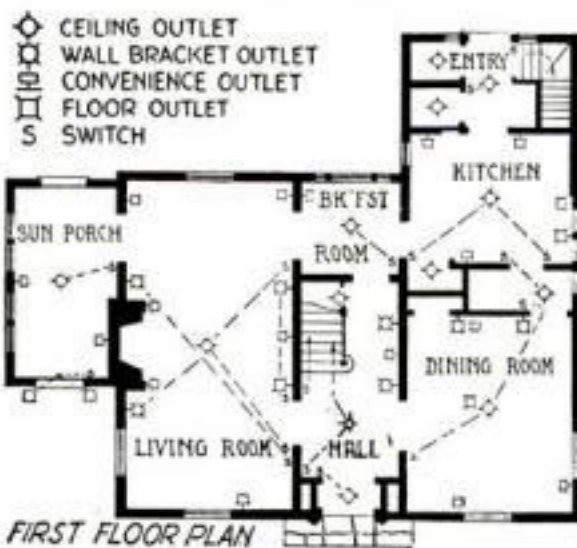
## Showing Bad and Good Lighting



Here two brackets throw light down on her work, another fixture lights the breakfast nook, and a fourth the entire room



SECOND FLOOR PLAN



FIRST FLOOR PLAN  
Courtesy Westinghouse Lamp Co.

Electric wiring plan for a well-lighted home, with symbols explained. "Convenience outlets" is a general term meaning outlets to plug-in portable lamps and electrical appliances

gas-filled lamp puts out eight percent of its energy in light. The lost energy goes off in heat and invisible rays. Incidentally, science compliments the worm by saying that its yellow-green light is the necessary color for maximum efficiency."

"ARE all lamps gas-filled or vacuum as the customer prefers?" queried the young woman.

"No, the smaller sizes are vacuum. Gas-filling is at fifty watts and up. The gas, which is argon with a trifle of nitrogen added, permits a higher temperature of filament to be attained—which increases light—and also retards evaporation of the filament substance."

"I didn't know that the filament would evaporate," said Rob. "It is tungsten, I understand, which is a pretty tough metal."

"Yes, and it evaporates gradually with incandescence. The process is slow, yet the vaporized material condenses and gathers on the bulb interior, darkening it and so decreasing light output. The effect is lessened by the insertion of chemicals in the bulb that keep the tungsten particles from forming a solid mass. Besides this decline in efficiency by darkening, thinning of the filament by evaporation increases resistance, lowers the rated watt consumption and decreases

correspondingly the output of light. "The average standard lamp is now rated to have a life of one thousand hours. You can keep using it into old age only at the loss of illumination. The manufacturers could make a longer-lived lamp, but it would be less efficient in light and would cost more in current. Throw away the old blackened bulbs and get new ones. Occasionally you will find a new lamp that is defective and fails to serve a full term. Variation of voltage on the power line may shorten lamp life."

correspondingly the output of light.

"I like the soft light from frosted bulbs," remarked Ellen.

"They are becoming deservedly more popular and in time may displace most of the clear bulbs in home use. We have had two extremes in home lighting, first gloom and then glare, from which we are now emerging. Glare comes from an unshaded or unfrosted lamp whose direct rays smite the eye; also by reflection from polished surfaces, whether enameled, gloss painted or varnished. You meet it still in the homes of some otherwise intelligent people. It causes eyestrain, makes jobs for the oculist, and even affects health. Glare is the insidious enemy of eyesight and should be abolished."

"BUT doesn't frosting reduce the amount of light?" asked Rob.

"No, or, rather, so little as not to count. The old-style outside frosting did cut down the output of light, up to one fifth of the total. We now have inside frosting whose maximum absorption of light after long use is only four percent more than clear glass. And the inside treatment makes it easy to dust or clean the bulb outside, which was not the case formerly."

"Inner frosting is done by etching the glass with acid. (Continued on page 138)



Two lights flanking the mirror insure an even job in shaving, eliminating shadows



Switches near doors make it easy to operate lights when you enter or leave rooms



This is a test model of a naval flying boat. These marvelously accurate models, aeronautical engineers say, teach them more than hours of actual flight

# They *Test* Planes Now without *Flying*

*Amazing Models, Put through Paces in Wind Tunnel, Solve Riddles of Balance and Speed*

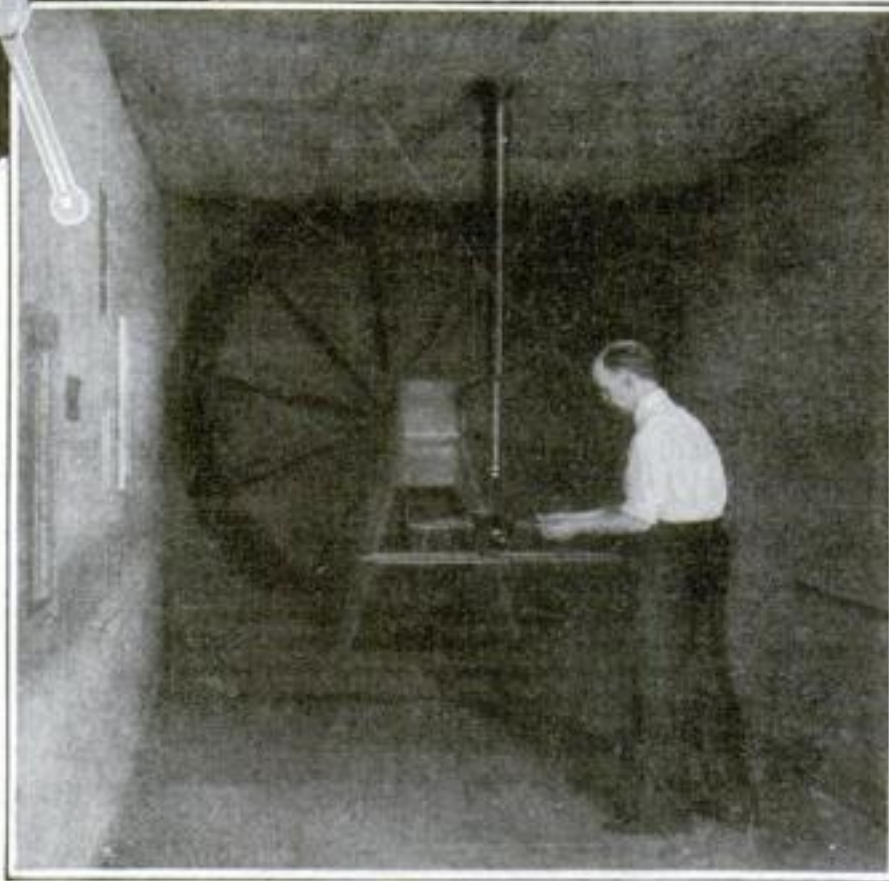
By  
G. H. DACY

**C**LUSTERED about a marvelous electrical instrument in a laboratory in Washington, D. C., a group of engineers eagerly watch the flickering dials. Beneath the floor under their feet, a gale of wind roars through a man-made tunnel. In the center of the tunnel, communicating with the instrument in the laboratory above, is suspended a tiny airplane—a mere toy, only two feet in wing spread. Yet on this little model hangs the fate of an inventor's hopes, for it represents a strange new plane of revolutionary design.

Not a life is endangered, nor is a costly giant of the air built only to be scrapped, in this triumph of science, the latest way to test new airplanes at the Washington Navy Yard. When an inventor offers Uncle Sam a new idea for an airplane, this method enables tests to be made at a total cost of \$500, as compared with \$50,000 if the actual machine were built. Engineers tell us the amazing fact that they can find out more from these wonderful little models than from many hours of actual flying.

Following the inventor's plans, expert craftsmen in Uncle Sam's workshop carve the diminutive craft out of mahogany. A skilled worker can complete such a reproduction within four days. From time to time as the work progresses, he measures the model and compares it with the dimensions on the large-scale plans. If there is an error no greater than the thickness of a sheet of paper in the wing surfaces, they must be refinished; for the models are reduced in size from twelve to twenty-four times, and a slight mistake in large-scale design becomes magnified to a serious error in a tiny model. Again and again the mahogany plane is checked for accuracy.

**W**HEN it is completed, it is a perfect miniature model of the huge man-carrier conceived by the inventor—except that it lacks motor and propeller. Now it goes to the proving ground—not to a flying field, but to a dim square tunnel that a man can enter erect with plenty of room



**Where Winds Are Made to Order**

Interior of the wind tunnel where the Navy tests new airplane designs—one of the largest tunnels of the kind in the world. Sensitive fingers on the end of the shaft grasp the model

to spare. An immense centrifugal fan, twelve feet across and many-bladed, is whirled by a 500-horsepower motor. It sends a blast of air through the passage, a cyclonic gust of 160 miles an hour if necessary, circling the 200-foot length of doughnut-shaped tunnel. From the ceiling descends a steel shaft. At its lower tip are sensitive fingers which, grasping the model, will relay to the scientists in the laboratory above news of what happens when rushing air meets plane.

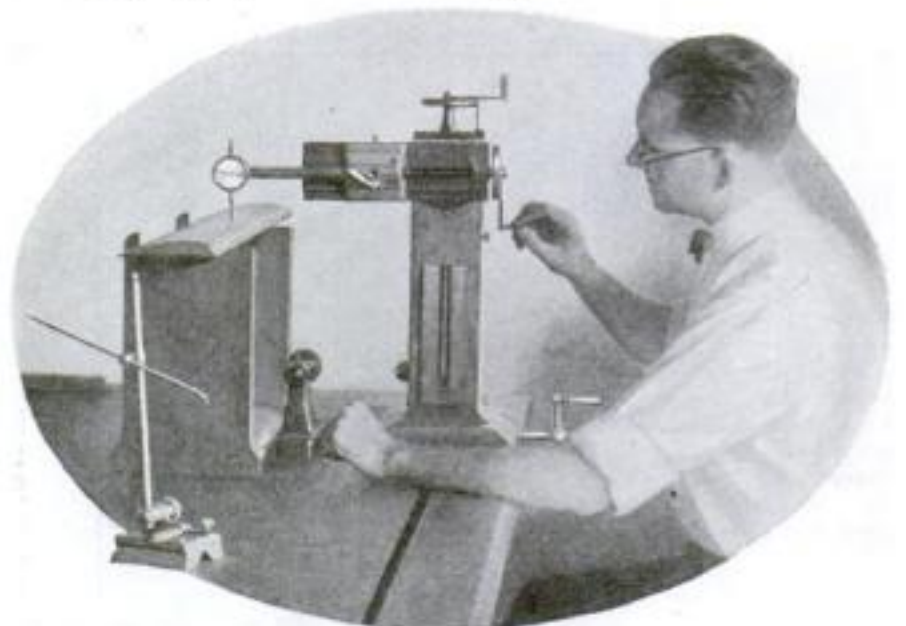
The critical moment has arrived. With meticulous care the toy-size machine is fastened in place on the shaft. The fan roars into action and is set to create a blast of forty miles an hour, standard for these tests.

The shaft, the balance arm of a strange weighing machine, communicates the plane's vibrations to

the remarkable instrument in the laboratory. This machine, invented expressly for the U.S. Navy, is the only one of its kind in existence. A masterpiece of electrical ingenuity, it reveals all conceivable reactions of the baby plane.

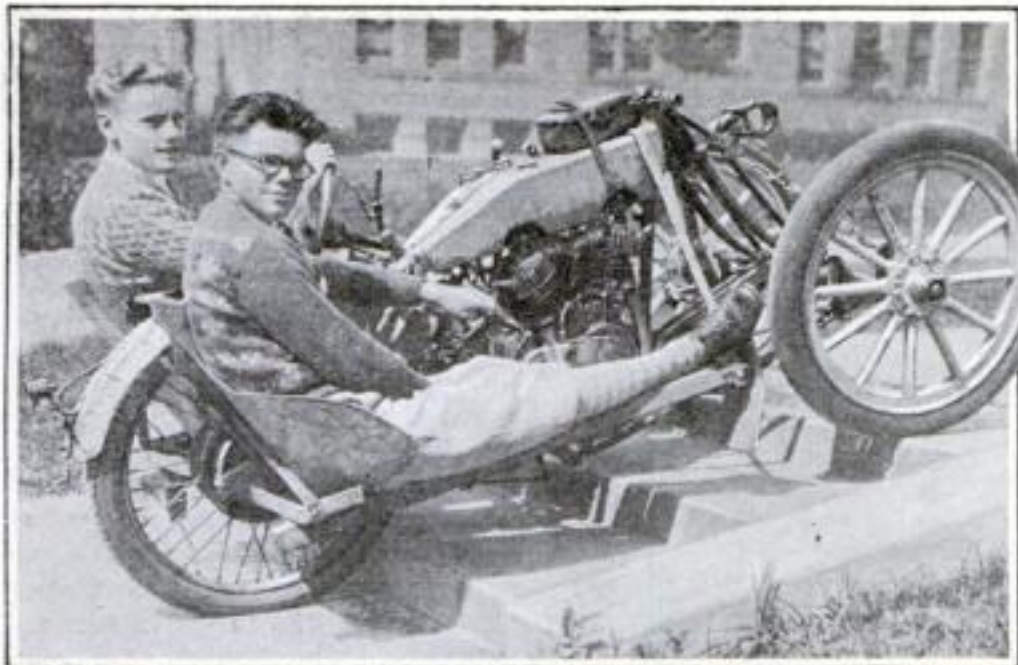
**H**OW much the plane will lift; whether it will "skid" in banking for a turn; whether it will fly in a straight line, or veer to left or right; and whether it is likely to take a sudden unexpected nose dive or turn up its nose and stall—these are some of the questions answered by this machine with almost human intelligence. A lift of ten pounds' force in the model may correspond to a ton and a half in actual flight; a drag of one and one quarter pounds, to four hundred or more on the big plane.

Several hundred new airplane types have been tested in this tunnel since it was opened some years ago, and we are indebted to it for much of our present knowledge of how to build aircraft. Airplane parts are also tested, and models of gas bags for lighter-than-air craft—curious "fish forms" to cut down air resistance. Even the effect of trade winds and storms on mammoth battleships is demonstrated in the tunnel by means of miniature craft and artificial gales.



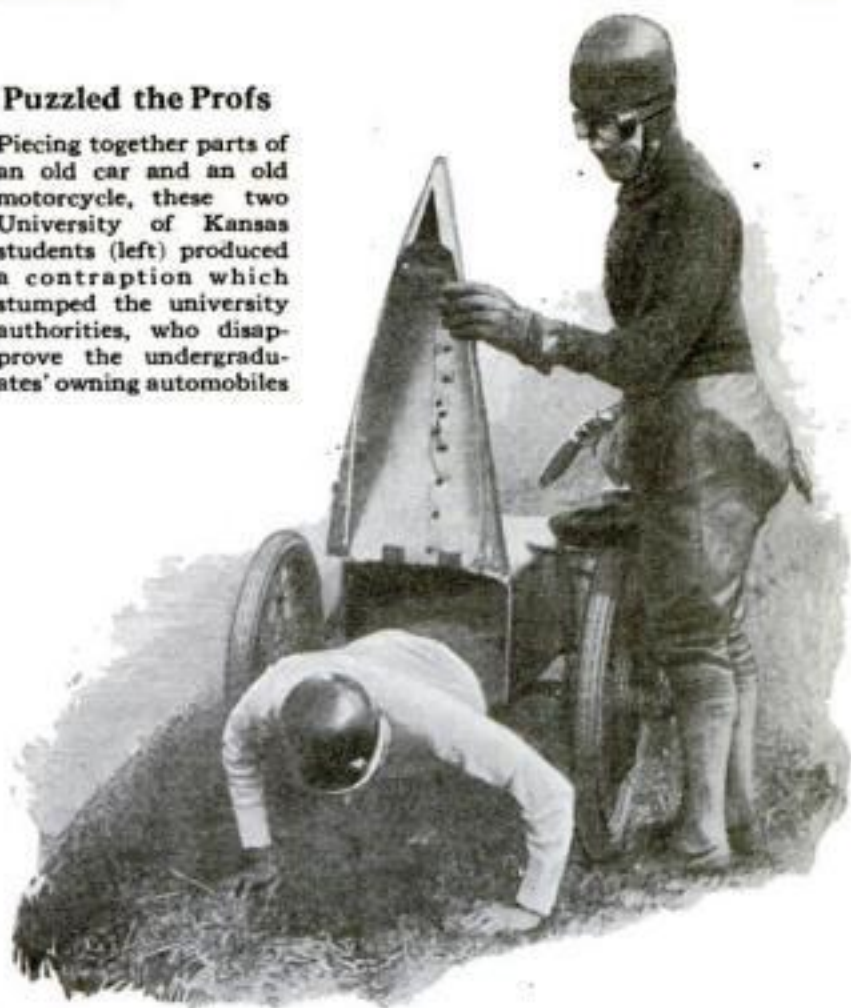
Measuring the wing surface of an airplane model preparatory to testing. Absolute accuracy to the thickness of a sheet of paper is required, for on that depends the whole value of these remarkable tests





### Puzzled the Profs

Piecing together parts of an old car and an old motorcycle, these two University of Kansas students (left) produced a contraption which stumped the university authorities, who disapprove the undergraduates' owning automobiles



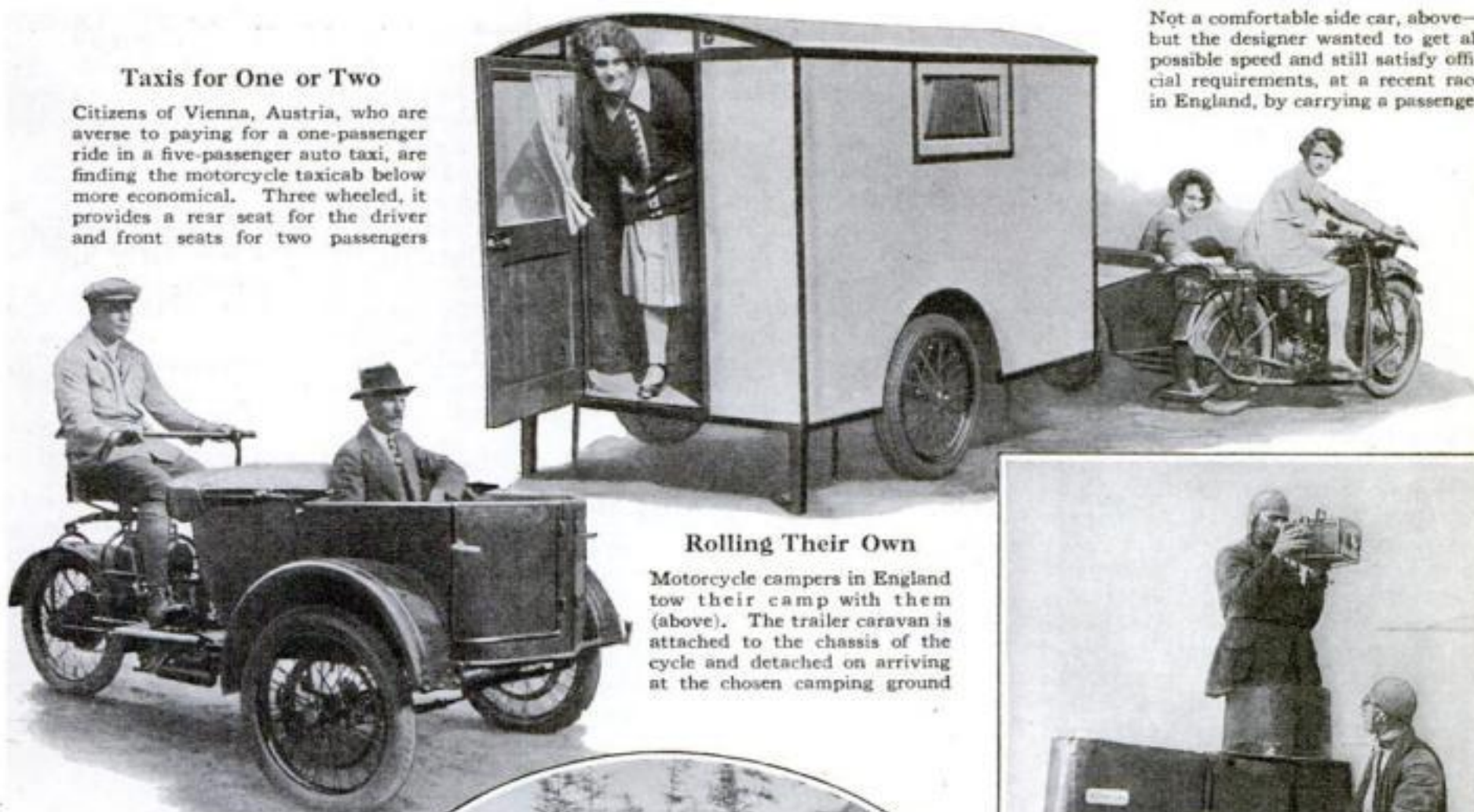
### He Crawls in Backward

Not a comfortable side car, above—but the designer wanted to get all possible speed and still satisfy official requirements, at a recent race in England, by carrying a passenger

# Strange Uses of Motorcycles

### Taxis for One or Two

Citizens of Vienna, Austria, who are averse to paying for a one-passenger ride in a five-passenger auto taxi, are finding the motorcycle taxicab below more economical. Three wheeled, it provides a rear seat for the driver and front seats for two passengers



### Rolling Their Own

Motorcycle campers in England tow their camp with them (above). The trailer caravan is attached to the chassis of the cycle and detached on arriving at the chosen camping ground

### Modern Travel in the Yukon

Dogs and horses and the picturesque snow sled are being replaced by motors for winter travel in the Yukon. The motorcycle at the right, on two runners and with a chain-covered wheel, covers the 275 miles between White Horse and Kono in three days—a trip said to take a four-horse team twelve days to complete



### Speed Kings of Photography

No time is wasted by the photographers of the Berlin firm owning the motorcycle outfit above. Photos are taken from the conning tower, developed in the dark room on the side car, and are ready to be distributed when they arrive at the office

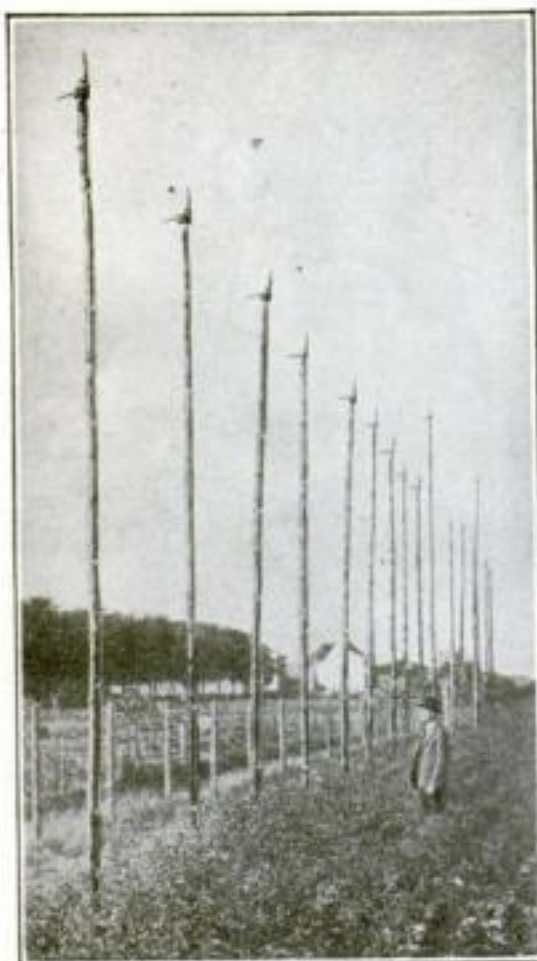


# Science Blazes

## *Serum for Measles, Electrified*

### Electricity As Soil "Fertilizer"

Can electric wires imbedded in the soil speed up plant growth? The experiment of raising vegetables by this method on a large scale has been made in Berlin, Germany. Copper wires running through the field a foot deep extend up a row of masts (left) to points which collect electric charges from the air. As for the results claimed—the little girl is holding a normal beet and one said to have been grown electrically



On these pages are presented each month brief stories of scientific discovery and research having practical bearing on our everyday problems.

### Sun Spots Make Us Healthier

**A** FEW weeks ago the Harvard University Astronomical Laboratory announced the discovery of a terrific cyclone on the sun, evidenced by an unusually great crowd of sun spots.

If you are a radio fan you probably said, "There goes the chance of good long-distance reception this winter," recalling the electrical effect of sun spots on the earth. But did you know that this solar storm may, in addition, definitely affect your health for the next year or so?

Dr. Edison Pettit of the Mount Wilson Observatory, California, tells us that the increase in sun spots results in an increase in the ultra-violet rays of sunshine which, besides causing sunburn, aid our bodies to combat germ diseases. When the eleven-year maximum of spots is reached within the next year or so, he says, the sun will give off about two and a half times as much ultra-violet light as it did in 1923.

In the same connection the British light-cure expert, Dr. Albert Eidinow, has just finished experiments supporting the theory that the health-giving effect of sunlight is due to some substance which the sunlight sets free in the blood. This substance kills disease germs, and its effectiveness varies with the amount of skin exposed to the sun. Too much exposure, however, he says, may do more harm than good.

### Scientists Test Radio Echoes

**H**OW radio actually travels has baffled even the scientists. Now an answer to the riddle is offered by two scientists of the Carnegie Institution of Washington, Drs. G. Breit and M. A. Tuve. By a strange experiment they appear to have demonstrated that radio transmission depends on a layer of elec-

trified air high up in the atmosphere.

The ordinary air we breathe, of course, is not a good conductor of electricity. Light and telephone wires in contact with the air do not lose their current. How then, men have asked, can radio waves travel through air? Scientists have imagined a layer of thin air a hundred miles or so above the ground, so highly electrified that it conducts electricity almost as well as a copper wire.

To prove the existence of this layer, Dr. Breit and Dr. Tuve directed radio signals upward toward it. "Echoes" which, the scientists were convinced, were sent down again to earth by the electrified layer, were detected.

### Voice Filmed for Talking Movies

**S**OUNDS actually registered on a film, instead of on a wax disk, are the basis of a remarkable new invention, the "pallophotophone," now being developed in the hope that it will mark a new era in talking movies. Charles A. Hoxie, an engineer of the General Electric Com-

pany, is the inventor. "Pallo" and "photo" are Greek words meaning "shaking light."

The device "films" the voice by means of a delicate vibrating diaphragm and a beam of light. When sound waves vibrate the diaphragm, the motion causes the light ray to fall upon a strip of film similar to a moving picture film. The picture-taking machine works in synchronism.

To reproduce the record, the sound film is wound on a reel so that it can be passed in front of an extremely sensitive electrical apparatus, creating an electric current which, amplified, operates a loudspeaker.

### Trailing the First Americans

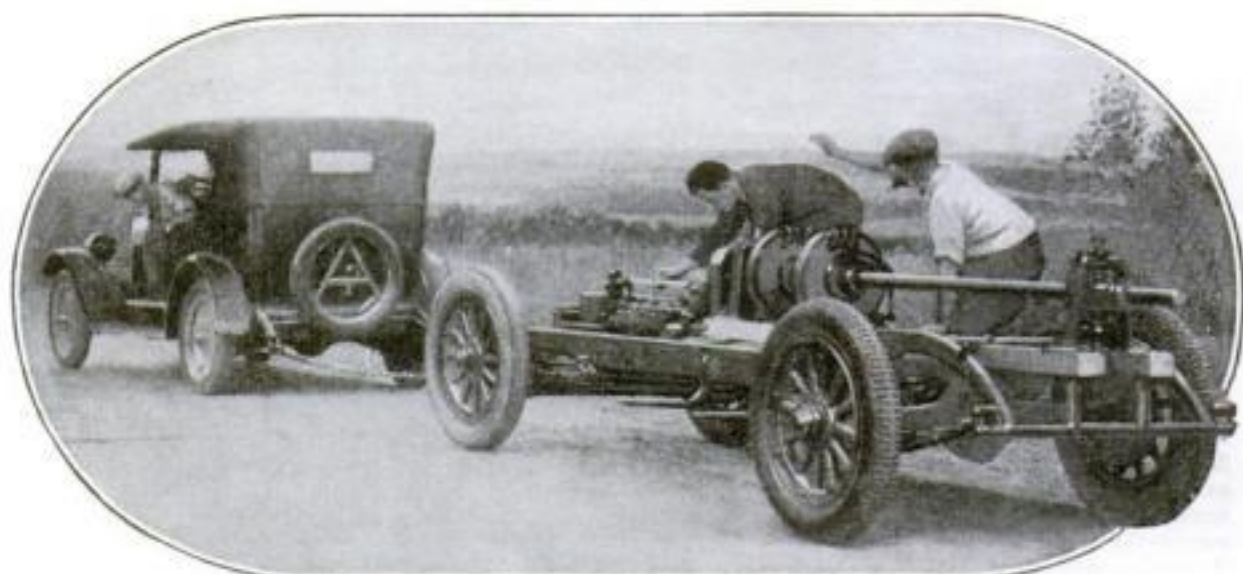
**A**LL during last summer a noted American scientist made his way through Alaska wildernesses on a most remarkable journey of discovery. He sought neither gold nor new lands. Instead, he was on the trail of new knowledge about the primitive men who first set foot on the American continent.

That scientist was Dr. Ales Hrdlicka, anthropologist of the Smithsonian Institution, Washington, D. C. Returning from his travels a few weeks ago, he brought back evidence which, he says, establishes beyond doubt the fact that North America's earliest settlers were Asiatic peoples who migrated here by way of the Alaskan peninsula.

### Strange Changeable Animal

**A**N ANIMAL which can change into another animal and then back to its original form, is the startling discovery, announced the other day, of Dr. Martha Bunting of the zoological department of the University of Pennsylvania.

The "animal" is one-celled, resembling a minute drop of jelly, and belongs to the amoeba family. It can transform



### Testing a Car's Hill-Climbing Power on Level Ground

Though it is traveling on level ground, the automobile above is going through a unique hill-climbing test devised by the General Motors Corporation. It is towing a dynamometer mounted on a chassis, the mechanism being designed to duplicate the terrific drag encountered by a car in ascending steep hills. A hill 1,000 miles long must be climbed, in effect, by a car to pass this test



# More *New* Trails

## Farming and Other Advances

itself into a complicated flagellate, Dr. Bunting says, and then effect a re-transformation back into its amoeba state.

In its amoeba phase, as described by its discoverer, the strange animal can round itself up and surround itself with a protective membrane within which it rests.

### Trace Sunken Atlantic Continent

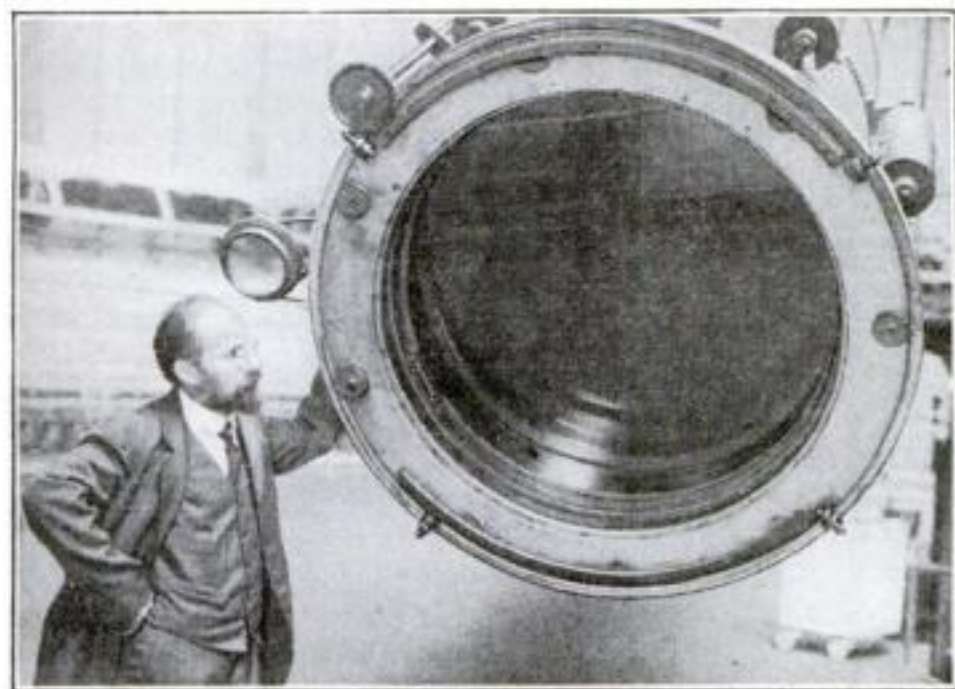
**T**HAT mysterious submerged continent beneath the waters of the Atlantic, already known to geographers, has had its boundaries defined more exactly by recent soundings made by the German survey ship *Meteor*.

The main part of the "sunken continent," these soundings show, lies between the southern tip of South America



**Bones of Strange Extinct Elephant Dug Up in California**

In a sand pit in California, forty miles from Los Angeles, were dug up the other day teeth, tusks, and bones of the Imperial Elephant, ruler of the animal kingdom more than 50,000 years ago. One of the mammoths unearthed is thought to be the largest of these extinct monsters ever discovered. The photograph above shows one of the tusks, which was badly decomposed, laid out for inspection.



### Mars Swings In for a Close-Up

The planet Mars was nearer to us on October 27 than it will be again for fifteen years, and astronomers everywhere watched the planet closely in an effort to collect further facts that might solve its mysteries. Dr. George Van Biesbroeck, of Chicago, is shown here with the famous Yerkes telescope with which he observed the planet. It has the largest lens in the world.

and the southern tip of Africa. Previous sounding expeditions have given geographers some idea of the location and extent of the submerged plateau, but this was the first time the new sonic depth finding devices were used for the purpose. By this method, an apparatus on the ship sends sounds down to the bottom of the ocean, and the speed of the echo returned indicates the exact depth.

Although much higher than the rest of the sea bottom, the "continent" itself lies from a mile to two miles below the waves. It was probably submerged many millions of years ago.

### Silent Sounds Guide Ships

**I**NSTEAD of baying blasts from fog-horns, sounds that no human ear can hear are being employed by a lighthouse at the port of Calais, France, to guide ships into the harbor in thick weather. These inaudible sounds are like ordinary sounds except that they are so shrill they cannot be heard. They can be detected, however, by electrical instruments which make them visible. They travel long

distances under the surface of the water.

At Calais, the lighthouse on shore transmits inaudible sounds in a code of dots and dashes. The signals travel under water and are picked up by amplifying devices on ships nearing the harbor. These devices are similar to those developed by the U. S. Navy and the Coast and Geodetic Survey for taking soundings at sea and for determining the distance of a survey ship from the coast.

### A Goat Serum for Measles?

**P**ROSPECTS for improved and practical methods of preventing that common bane of childhood—measles—look promising, according to Dr. Ludvig Hektoen, chairman of the medical division of the National Research Council.

A small round germ of the kind called coccus, declared Dr. Hektoen recently, has been shown by research workers to be present in our blood in the early stages of measles. The blood of goats that have been injected with these germs, he said, acquire immunizing properties that act as a preventive of the disease in humans,

This goat serum, when injected experimentally into susceptible persons not later than the fifth day after exposure to measles, prevented the onset of the disease in ninety percent of the experiments.

### Not All Birds Shun Divorce

**O**UR idea that birds never get divorces but stick to their first loves throughout life received a rude jolt the other day when S. Prentiss Baldwin, of Cleveland, Ohio, announced the results of a ten-year intensive study of bird habits.

Mr. Baldwin kept a day-by-day record of the lives of a number of household wrens which nested on his estate. These wrens, according to his report, usually raised two broods of young a year. But each year, between the broods, the parents usually changed mates. The mating lasted only while the young birds were helpless; after that the parents felt quite free to make a new marital arrangement.

### Her Feat Was Creating Nothing

**C**HANNEL swimmers and Babe Ruth are not the only ones who have been breaking world's records. As this is written, a woman scientist of Vienna, Mme. Anna Schiermann, claims the distinction of coming nearer than anyone else in the world to producing absolutely nothing!

In a glass bulb in her laboratory Mme. Schiermann has produced a vacuum so nearly complete, it is reported, that the amount of free gas left in it can hardly be detected. It is so small that it causes a pressure of only one fifty-billionth of a pound per square inch.

Ordinarily, in obtaining high vacuums, specially prepared carbon is used to absorb remnants of the gases not removed by powerful air pumps. In place of the carbon Mme. Schiermann substitutes tungsten filaments which, she says, have proved more efficient.



# Wonders of Everyday Things

*How Insects Give Us Shellac and Ink—The Head-Hunters of Borneo—Can Rain Be Made Artificially?—More Reviews of New Books*

By THOMAS M. JOHNSON

**"Modern Aladdins and Their Magic"**

By Charles E. Rush and Amy Winslow,  
Little Brown & Co.

**"Here and There in Popular Science"**

By Jean Henri Fabre, Century Co.

**D**ID you know that the shellac on your hardwood floors was made by insects, called the lac insects, probably in India? Soon after these insects hatch out, they attach themselves to twigs of trees and proceed to shellac the branches, coating them with a resinous substance which is collected and purified, to become ground.

The ink on your desk comes from insects too, and from fish. In Asia the gallfly "lays ink" on oak trees under the bark. Lumps or knots grow over the eggs, and these "nut-galls" are cut off, soaked in water, mixed with green vitriol, mucilage and acid. The result is the best ink made. The ink in your fountain pen, however, is probably made from an artificial dye because it is smooth and does not thicken.

The varnish on the chair you sit on is made of sap, hardened from lying in the earth thousands of years. Perhaps it melted and flowed into the earth when the forests were burned. Thousands of people make a living digging this gum in lumps from the ground.

The chalk children use in school is made from the skeletons of sea animals that lived thousands of years ago. You can see them by looking at chalk with a powerful microscope. These tiny animals died, and their bones accumulated on the limestone sea bottom. Then earthquakes brought up the sea bottom and it dried, forming chalk pits composed of the skeletons, so small that it takes a million of them to make a cubic inch of chalk.

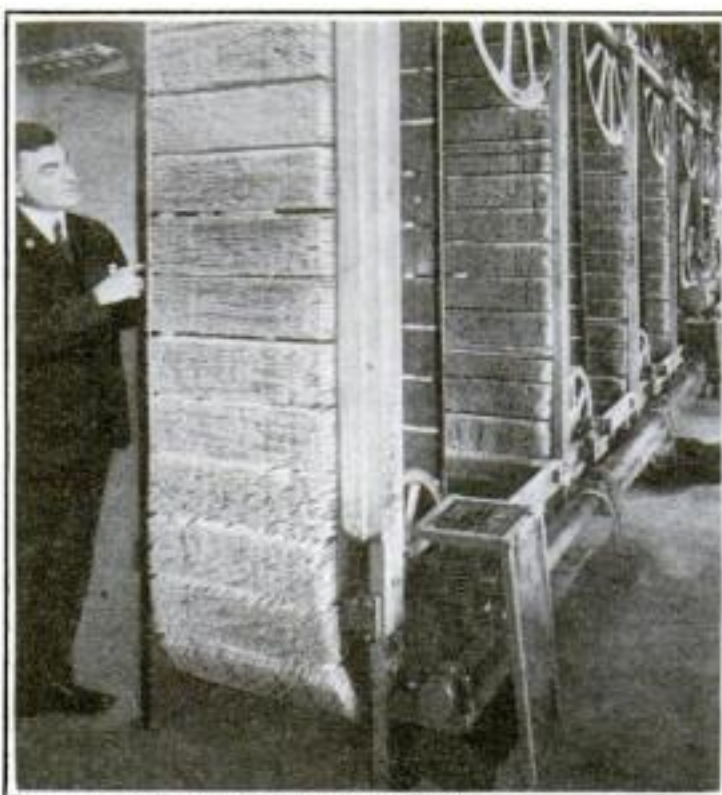
**Y**OUR aluminum kitchen utensils are made from mud. It took two hundred years to discover how to extract this light silvery metal from the earth. And the asbestos mats in your kitchen were dug up from the earth. This substance, impervious to heat, is a mineral that is mined, then winnowed and spun.

These miracles, the results of which we see before us daily, we take for granted. We meet them in our own homes, in the streets, but we pass them by without a thought. They, and many others of the wonders of everyday life about us, are told in *Modern Aladdins and Their Magic* and *Here and There in Popular Science*.

If some enterprising person, we learn, had not smuggled a machine into this country in a cargo of salt more than a

hundred years ago, we should not have the knitting industry that gives us our stockings. England was trying to keep the invention secret. The silk of which stockings are made was a secret, too, for centuries. It was long a capital crime to carry silkworm eggs out of China.

Marvelous photographs can be made



From "Modern Aladdins and Their Magic"

How matches are made: This amazing machine carries and dips one million matches at a time

today showing the different steps in the bursting of a soap bubble shattered by a bullet. The exposure lasts 1/3000th of a second. Yet the first permanent photograph was produced only 100 years ago.

Another little known miracle of the world about us is that the plants in our gardens sleep at night, just as we do—that is, most of them do. All plants with delicate leaves sleep, and curl up at night to do it. Every plant has a characteristic attitude for nightly slumber.

**"Evenings with the Stars" and  
"The Romance of Comets"**

By Mary Proctor, Harper's

**F**LAMING crucibles of the heavens are the seven stars of the Great Dipper, most familiar of the constellations. Each of them is a mighty molten sun, probably greater than our own sun; a fiery furnace in which such stubborn metals as steel and iron are reduced to glowing vapor.

Air upon these suns is a mixture of iron and zinc steam. The clouds that form over such a world are metallic drops; its rains, molten metal.

Five stars of the seven seem to drift together, forming a sort of drifting set in the sky; the Dipper is changing, and thousands of years from now children may not be taught to look for it in the sky because it will not be there.

In fact, all things are changing continually in the sky. There are old stars and young stars, and we can tell their ages by their colors. The young star glows an ardent red. Then, as temperature increases, it becomes yellow; then white or blue. The brilliantly white or blue stars are hottest and in the prime of life. As they cool, they become yellow and finally red again, before they flicker out.

If we lived on a planet belonging to the system of Antares, our sunlight would be green or red, as one sun passed over the other. For there is a green star, a companion to Antares, whose softer light is usually obscured from the Earth by the ruddy glare of the great Antares.

The writer of *Evenings with the Stars* and *The Romance of Comets* tells these wonders of the skies on a plan somewhat new. We make the acquaintance of the stars and constellations on a series of twelve "nights with the stars." At the same time that we hear the ancient tales about them, we learn to pick them out in the sky, using a church steeple, a tree or a chimney as landmark and perhaps an opera glass as "telescope."

There really is little danger from shooting stars, we learn from the book on comets, for before they reach the Earth they burn to ashes.

**"Rain Making"**

By W. J. Humphreys, Williams & Wilkins

**W**HERE has the old-fashioned winter gone? Where are the wonderful sleighing and skating of other years?

The scientific answer is—right here, of course. The weather isn't changing, and the instruments show it isn't. There has been no persistent climatic change whatever since weather records began to be kept, Mr. Humphreys says, and he is associated with the Weather Bureau. It is we who are different, not the weather.

Can rain be made to order? Mr. Humphreys doesn't believe that, either. There isn't much use trying to bring on rain until Mother Nature is ready, he says. Take, for instance, the belief that thunder brings rain. Here is the truth:

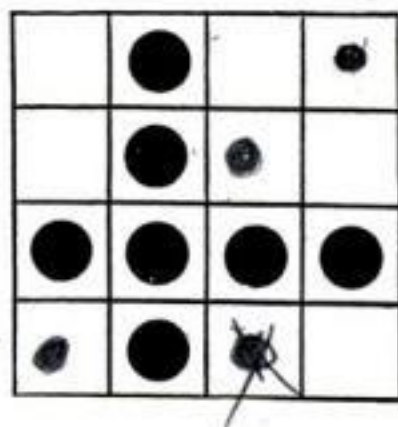
It takes electrical separation to produce a heavy peal of thunder, and for that there must be a correspondingly large amount of sus- (Continued on page 113)



# Try Your Wits *at* These Tests

*Six More Sam Loyd Puzzles to Help Measure Your Abilities—Your Ratings and Solutions on Page 136*

## Does Your Memory Play Tricks?

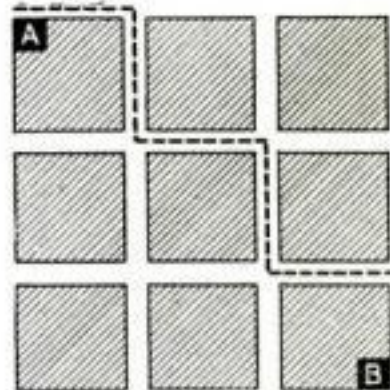


**V**IEWING these seven black checkers as rows—vertically, horizontally and on the various regular diagonals—you see that seven rows have an even number of checkers, two or four. Where would you place three additional checkers, in centers of the small squares, so as to increase to sixteen the rows having even totals? This is a test of your memory and powers of analysis. The solution appears on page 136.

**O**N THIS diagram of nine city blocks, the dotted line represents as short a route as is possible in the middle of the road between the two points A and B. There are, however, other routes just as short. If you took that trip daily, in how many ways could you vary it without increasing its length?

Figure this out in your head, without putting pencil to paper—then turn to page 136 for your rating.

## Have You a Good Sense of Direction?

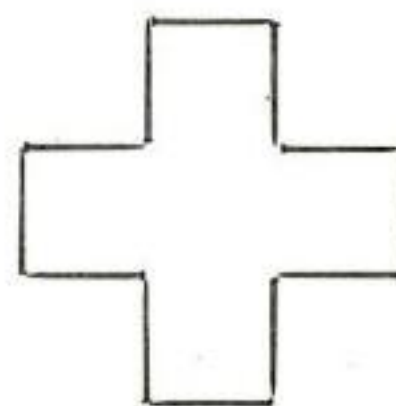


## Untying Word Knots

**A** PALINDROME is a word, phrase or sentence that reads the same backward or forward; as, for example, the Napoleonic "Able was I ere I saw Elba." How quickly can you construct a palindrome from the following letters?

A A A A W W S S I I T T C

Your speed will determine your skill at imaginative word play—find your rating on page 136. As a tip—a feline figures in this sentence.



## Have You a Good Business Head?

**F**ARMER WILKINS sold a pair of cows for \$210. On one animal he made a profit of ten percent, and on the other he lost ten percent; but on the double deal he cleaned up just five percent. What did the cows cost him, respectively?

Here's a little exercise that should show how you stand in mental arithmetic. Turn to page 136 for your rating.

## This One Takes Mental Agility



**E**ACH of these five pairs of disks is to contribute a disk to fill the intervening spaces—A, B, C, D and E; and as each numbered disk is jumped to its letter, it must pass over two other disks. Thus the opening jump might be 1 to B; 3 to A or D; and so on. A disk may be jumped over two single disks, too. Time yourself. Then turn to page 136.

## Have You an Eye for Line and Form?

**I**F EACH of the twelve pins forming the Greek cross above is an inch long, the space inclosed is five square inches. Your task is to rearrange those dozen pins, without measuring instruments, as a continuous fence inclosing a space of only four square inches.

Note the time it takes you—then find your rating on page 136.

## Two Magic Tricks You Can Do—By KENNETH B. MURRAY

### The Traveling Glass

**T**HIS surprising experiment consists of placing a glass of water in a hat, removing it under a bandana handkerchief, and throwing the whole over the spectators. The glass is found to have disappeared, and then to have traveled back into the hat!

The secret lies in having the handkerchief made double, with a wire ring, the shape of the top of the glass, sewn in it. The glass is left in the hat and the handkerchief, held by the ring, lifted as if it contained the glass.



The handkerchief is sewn diagonally, so that the ring can be shifted about



Here is the way the cigar actually looks, "thrust" through the hat. Upper picture: The completed effect—the other half being inside. Have a duplicate cigar handy

### Spearing a Hat

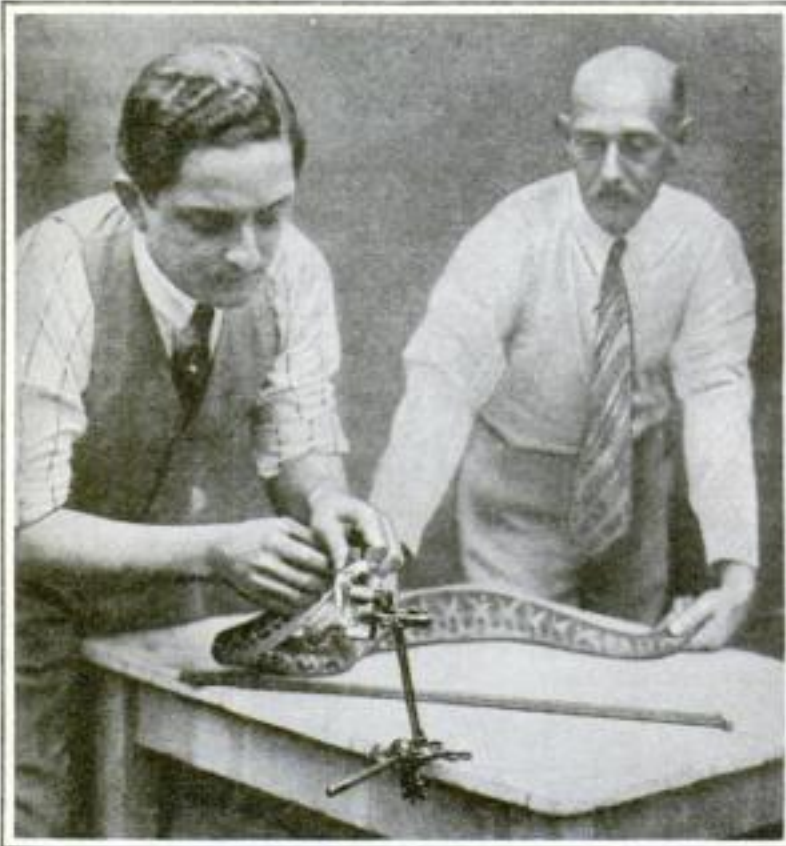
**P**USHING a cigar through your friend's best hat always provides endless amusement—at least to the other spectators.

Cut the cigar in half beforehand, and imbed a part of a needle in one half. Quickly, and concealing the cut end of the cigar during the entire performance, shove the needle into the hat with the left hand and with the right hand push the other half of the cigar, inside the hat, on the other end of the needle.



# Brazilian Helps Us Fight Snake Peril

*Bite Serum Soon to Be Sold in Drug Stores*



Dr. Amaral, the world-famous snake expert, demonstrating to Mr. Ditmars (right) of the New York Zoological Park his method of extracting venom from a reptile

Sucking enough poison to kill ten men—below, Dr. Amaral, drawing the venom into a tube



Mouth of a poisonous reptile, showing fangs from which venom is drawn to make serum

**V**ENOMOUS snakes are made to yield their poison, and for the first time a famous snake bite serum is being produced in the United States, at the New York Zoological Park.

A few months ago Raymond L. Ditmars, curator of reptiles at the zoo, visited the largest snake farm in the world, at Sao Paulo, Brazil, to study methods of extracting the venom of poisonous serpents and making it into antitoxin. There, under the guidance of Dr. Afranio do Amaral, head of the farm

and world's foremost snake expert, Mr. Ditmars observed how reptiles were handled to obtain the deadly fluid. On his return, he commenced the work of producing the serum in this country, and Dr. Amaral, paying a return visit, has been collaborating with him.

Snake serum standardized and distributed so that it can be purchased by anyone over the counter of any drug store, has long been a need in the United States. Up to now our supply of the life-saving antitoxin has come from

Dr. Amaral's farm in Brazil. To extract the poison from a snake's fangs, the serpent is pinned down with a long stick and grasped behind the head, the deadly jaws kept out of harm's way. Held over a container covered with cheesecloth, the enraged snake bites the rag and releases a flow of venom heightened by hand pressure on the poison sacs in its head. Small quantities of the poison are diluted and injected into horses, which gradually acquire immunity to it. From the horses' blood the serum is made.

The only certain cure in case of snake bite, says Dr. Amaral, is prompt application of this snake bite serum.

## Government Fabric Tests Tell Us How to Buy Clothes

**W**HAT makes some winter coats warmer than others?

Uncle Sam's Bureau of Standards has just completed a series of experiments to answer this question. The results have upset some of our pet notions about the warmth of the goods from which our suits and overcoats are made.

They show, for one thing, that a coat made of cotton can be just as warm as a wool one. It is not the kind of fabric that makes the difference in warmth, but the way the fabric is woven.

In the experiments, the fabrics were put through three different tests, measuring their ability to resist wind and air, heat, and moisture. In every case it was found that resistance depended not on the

kind of fabric, but on the closeness of the weave.

Finally, the tests so far have led to the conclusion that fabrics of moderate

density are more effective in retaining heat when not exposed to wind, while the denser, heavyweight fabrics are better for keeping out the wind.

The heat retention tests are made with a square metal plate, electrically heated. Samples of the fabric are clamped down on both sides of the plate so that no heat can escape except through the fabric. The escaping heat is then measured electrically.

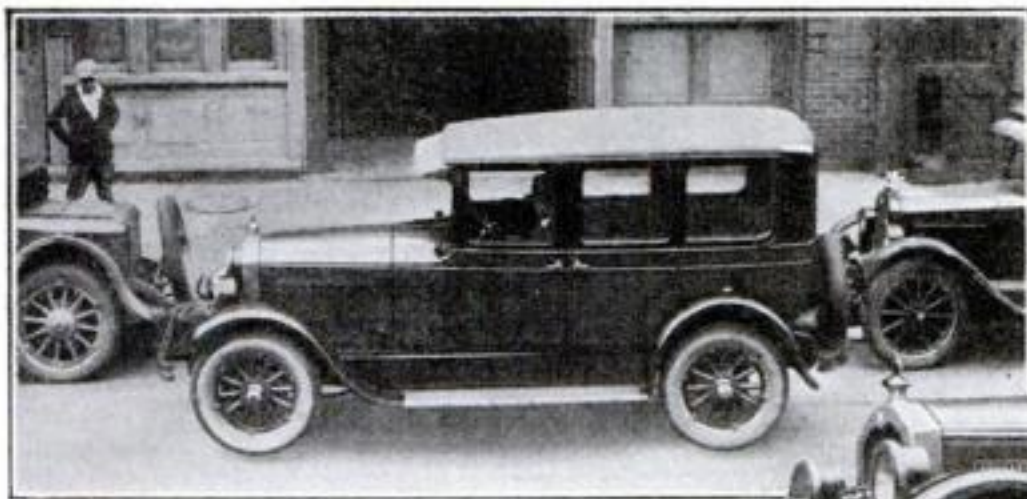
To study the problems of textile manufacture, the bureau has constructed the laboratory-size textile plant pictured here. Air conditioning apparatus, a part of which is seen at the ceiling, permits regulation of temperature and humidity to obtain any desired working conditions.



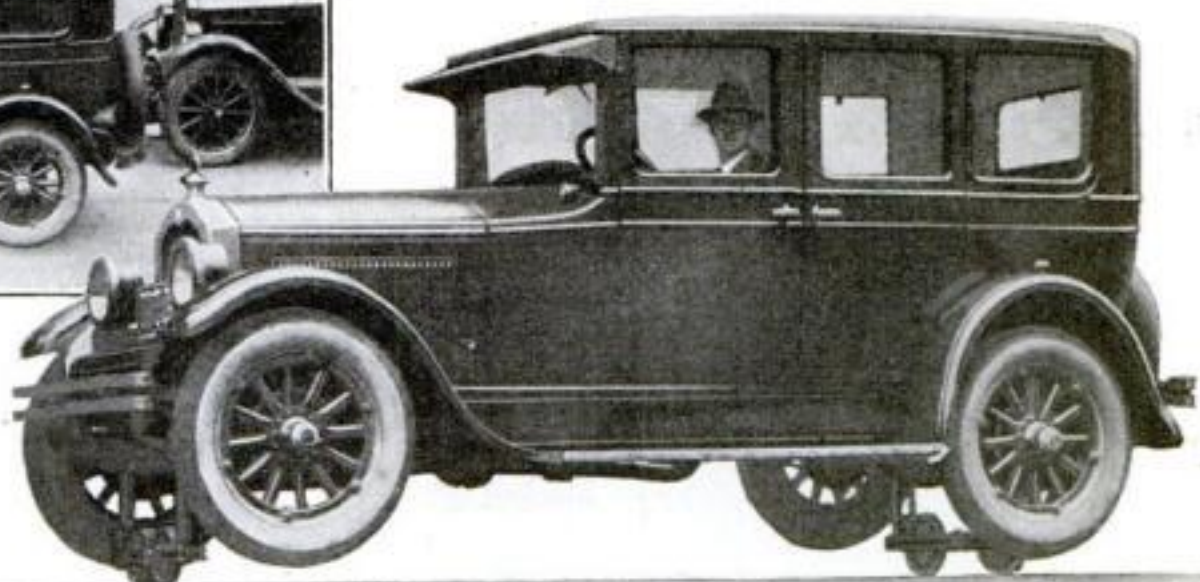
Experimental "textile mill" where Government experts are testing the fabrics our clothes are made of. Varying "weather conditions" are produced here



# You May Drive Your Next Car Sideways



Above: Moving sideways to the curb between two cars and not touching either. Right: Car raised off the ground for the sideward move

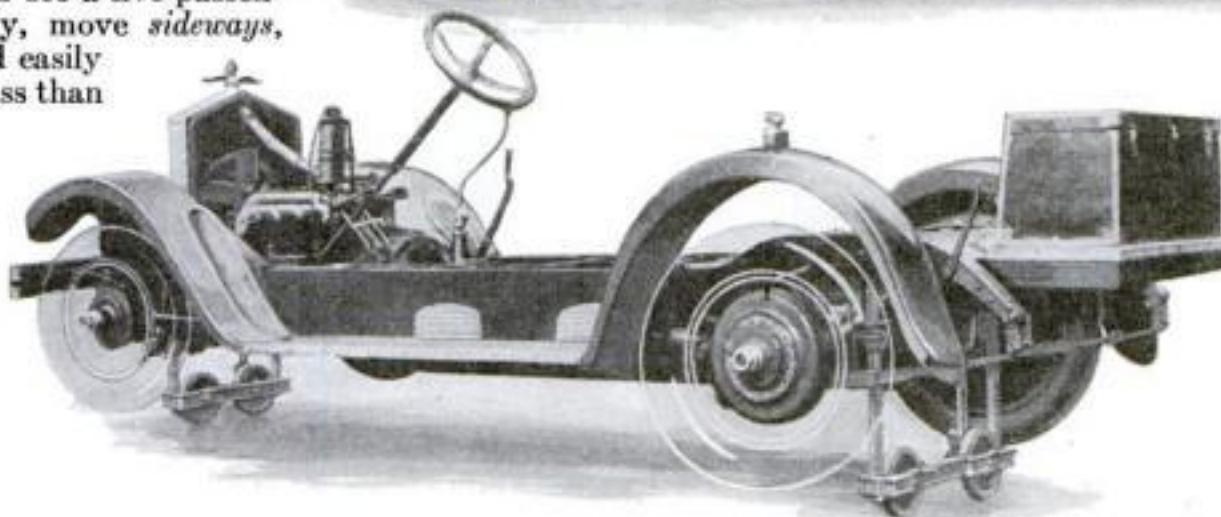


ON A crowded street in Baltimore, Md., the other day, passers-by were amazed to see a five-passenger car stop suddenly, move *sideways*, and slip smoothly and easily into a parking space less than two inches longer than the car itself!

With the halting of his car, the driver had thrown out his clutch and moved a small gear lever. His engine kept on working. With the shift, the automobile began rising from the pavement. Within a few seconds the wheels

were a full three inches from the ground. Then the driver shifted the lever once more and the vehicle began to move sideways toward the curb, between two other cars. Immediately against the curbstone but without touching, the driver, pressing on the clutch pedal, brought the side-wise journey to an end.

This remarkable feat was accomplished through the use of an ingenious new parking device, the invention of Villor P. Williams, a Baltimore engineer. The device carries four small, solid-tired wheels, concealed beneath the chassis of the car close to the vertical plane of



Left: How the four auxiliary wheels are attached and controlled by special levers. Note their position at right angles to the main wheels of the auto

each axle. They are set at right angles with the frame.

These small wheels are made to descend through the use of a worm gear, connected with the transmission, and operated by the engine of the car. When the small wheels touch the pavement, the worm gear continues to work, exerting powerful downward pressure, with the result of lifting the car bodily.

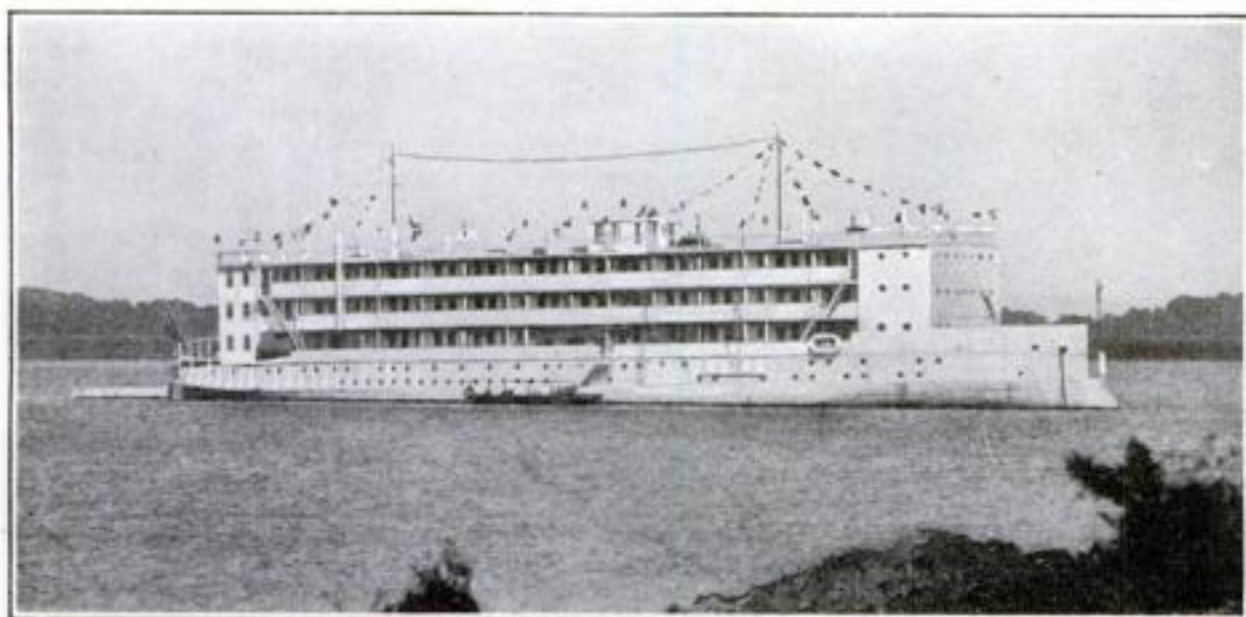
When the 3800 pound weight is supported by the auxiliary wheels, a shift of the special gear-lever operates a mechanism which causes the car to move sideways on the small wheels. This, too, is

accomplished by means of the car's motive power, and without the driver's having to leave his seat. The sideward motion may be continued indefi-

nately—across the street or for the full length of a boulevard.

After being halted, the car may be lowered again or it may be left "in the air." Removal of the vehicle from the restricted parking space is merely a matter of reversing the process.

Other advantages of the device, besides its application to parking, are pointed out by the inventor. Because it enables the driver, in his seat, to lift the car clear of the ground, it does away with the hand jack in changing tires. Similarly, the added clearance simplifies the task of making repairs underneath the car.



Once an ocean fighter for Uncle Sam, now fulfilling the more peaceful purpose of ocean hotel for pleasure-bent vacationists—the former U. S. S. *Amphitrite*, anchored off Beaufort, S. C.

## Old U. S. Monitor Now a Floating Hotel

HONORABLY retired from the Navy, the U. S. S. *Amphitrite*, a war vessel of the monitor type, has been converted into a palatial and luxuriously equipped hotel. The large rooms within are in striking contrast to the usual small cabins.

Its dazzling whiteness and fluttering flags make the former monitor a picturesque sight off Beaufort, S. C., where it is anchored for the winter. Next summer it will journey to Long Island Sound. The made-over ship has a length of 265 feet, and is fifty-five feet wide. Its shallow draft enables it to be anchored near land, and small boats are used to ferry the hotel guests to and from shore.



## Novel Fire Escape Formed by Cable and Belt



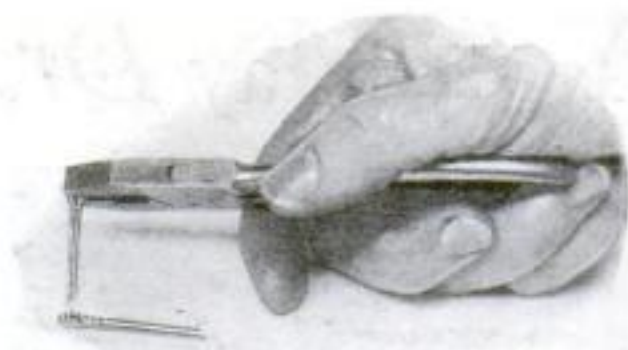
Sliding down the new "fire escape." He controls the speed by means of a thumbscrew

**D**OWN a steel wire to safety, supported in a safety belt, slides the user of this latest type of fire escape, produced in England.

Trapped in a burning building, if you're lucky enough to have this outfit on hand, you quickly attach the long wire cable to the window sill or any other support, drop the wire out of the window, and adjust the screw that fastens the belt to the wire. Then you slip into the belt and slide down.

The supporting belt is hung on the wire by means of a wooden block having a zigzag slot cut in it for the cable to pass through. The speed of descent is controlled by a thumbscrew in the block which provides tension on the wire.

It is a device which should be kept handy, the inventor thinks, in every high building, even where there are the usual fire escapes, for these are frequently blocked off.



### This Cotter Pin Won't Slip

**O**IL and grease on the machinist's hands make it a tricky job for him to fasten a cotter pin without slipping. The roughened surface of the improved cotter pin in the picture above provides a good hold, giving him a pin easier to grasp in the jaws of his pliers.

### Versatile Clock Runs the House

**W**ITH almost human intelligence, a recently invented clock assumes the usual duties of a responsible housekeeper. At any time desired, the timepiece turns the lights in the home on or off. Besides showing the time of day, it has two additional hands to indicate the day and the month.

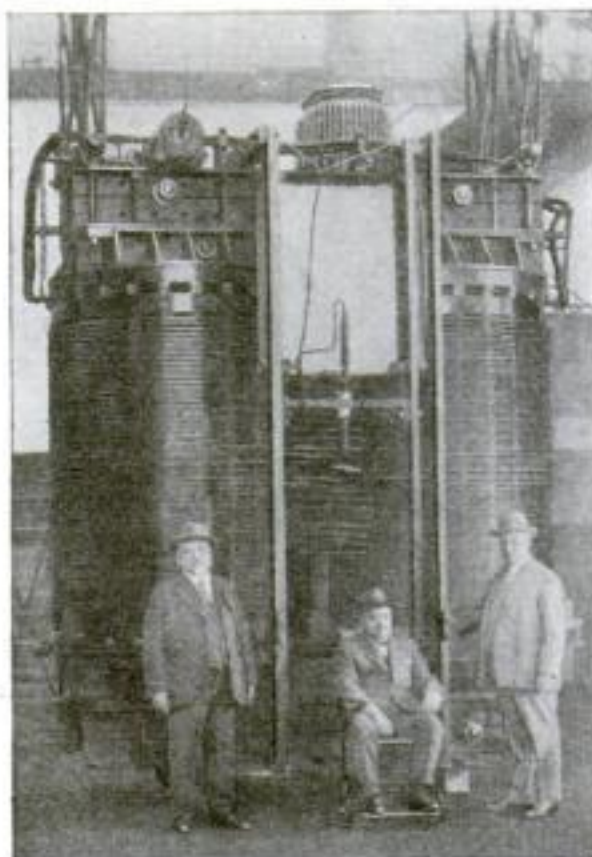
Outwardly resembling an ordinary clock, the new device contains a built-in electric motor that takes its supply from the house current. Accidentally deprived of this power source, it will still run for four days without winding, it is said; and will "pick up" the lost windings when the current is again turned on. Its inventor is Dr. J. F. Van Slyke of the Horological Institute of America.

### World's Largest Transformers

**B**IGGEST of their kind in the world, four gigantic single-phase transformers have been built by the General Electric Company for the Pennsylvania Power and Light Company. In the photograph at the right are seen the coil and core of one of these mighty units. They have an overall height of nearly twenty-four feet, a length of eight feet and a width of about twelve feet.

Four of the units were constructed, three to be used in one bank and the fourth for a spare. The total weight of each is 202,200 pounds, of which the oil weighs 79,000 pounds. Each has windings for 11,000 volts.

Standing in front of the transformer are, left to right: W. S. Moody, engineer; G. Faccioli, engineer; and C. C. Chesney, manager, all of the General Electric's Pittsfield Works.



A notable engineering feat: coil and core of the world's biggest single-phase transformer

### Locomotives Get Speedometers

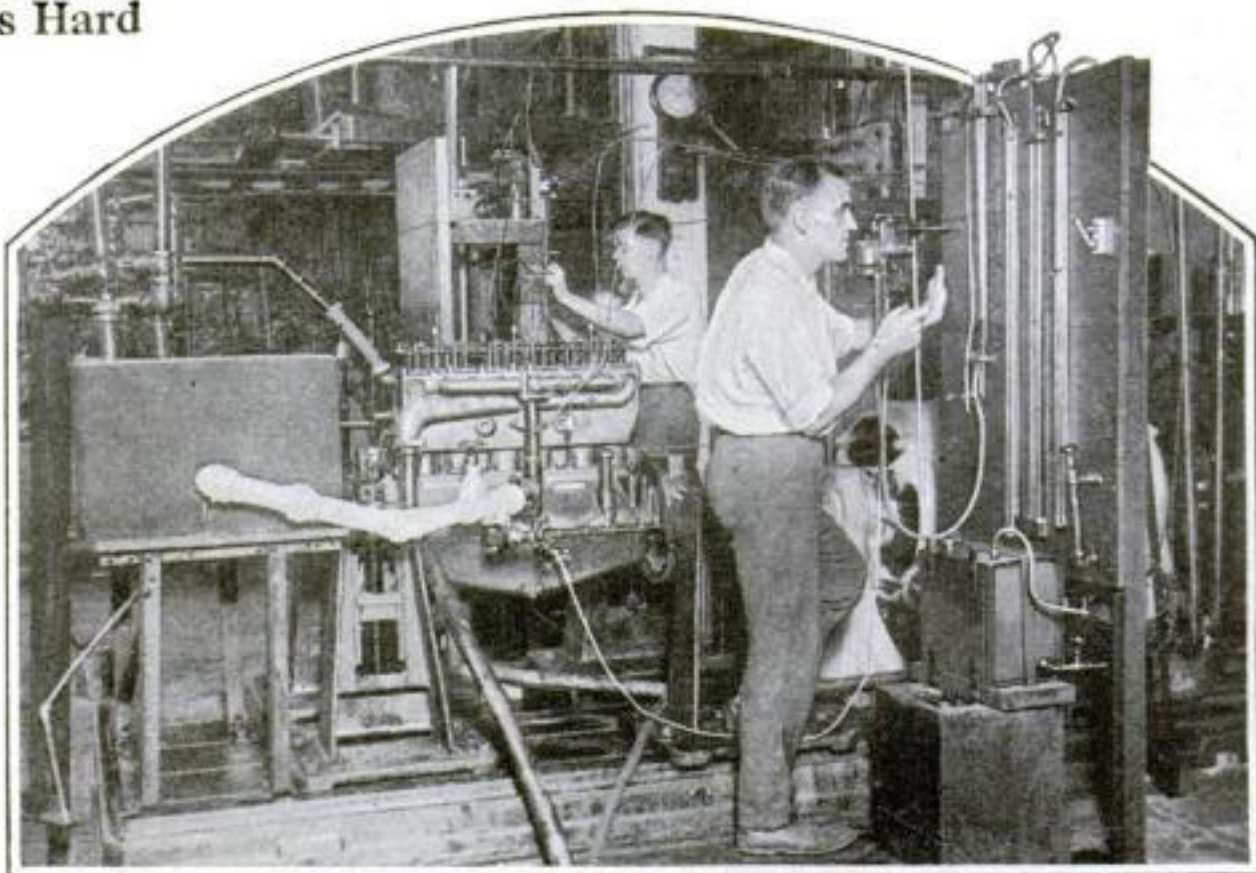
**A**T LAST locomotives have been fitted with speedometers, the swaying and vibration of the train having long hindered the accomplishment of this feat. Electrically operated, the new device employs a magneto run by the engine wheel. An indicator, calibrated in miles per hour instead of volts or amperes, is mounted in the cab.

### Why Your Auto Engine Starts Hard

**M**OTORISTS everywhere will follow with interest the experiments now being made by Bureau of Standards experts John O. Eisinger and Stephen A. Buckingham, to find why an automobile motor starts hard in wintertime.

To simulate actual winter conditions for these tests, brine at freezing temperature is circulated through the water jacket of the motor and even the air supply to the carburetor is refrigerated. A careful check is kept on all operating conditions; various temperatures are tested with all kinds of gasoline as well as different motor compression ratios and self-starter motor speeds, and the results noted.

It is expected that the results of the thousands of experiments will help both the automobile manufacturers and the oil industry to overcome winter hard starting troubles. Already, says Mr. Eisinger, there is a tendency on the part of oil companies to improve gasolines in regard to their starting characteristics.



Testing engines and fuels at the Bureau of Standards to solve starting troubles





### It's Wrench and Hammer in One

**A**N ALL-PURPOSE tool combining several useful features is this odd-looking combination hammer and wrench. Its versatile jaws drive a nail or twist a pipe with equal ease. A right-angled claw removes nails even in cramped quarters. Round surfaces are firmly gripped with the Stillson-type jaw.

### Soap Mining a New Industry

**N**EAR Death Valley, in California, there exists the unique paradox of a soap mine, which has recently given rise to the strange new industry of mining soap. From this mine is dug amargosite, a soft smooth rock, rather sticky. A lump of the mineral breaks up when shaken with water, making a soapy liquid having excellent cleansing properties.

Observing the Indians using it, R. K. Fairbanks, a pioneer settler of the Shoshone country, succeeded in finding out where it was obtained.



### It Massages While You Swing

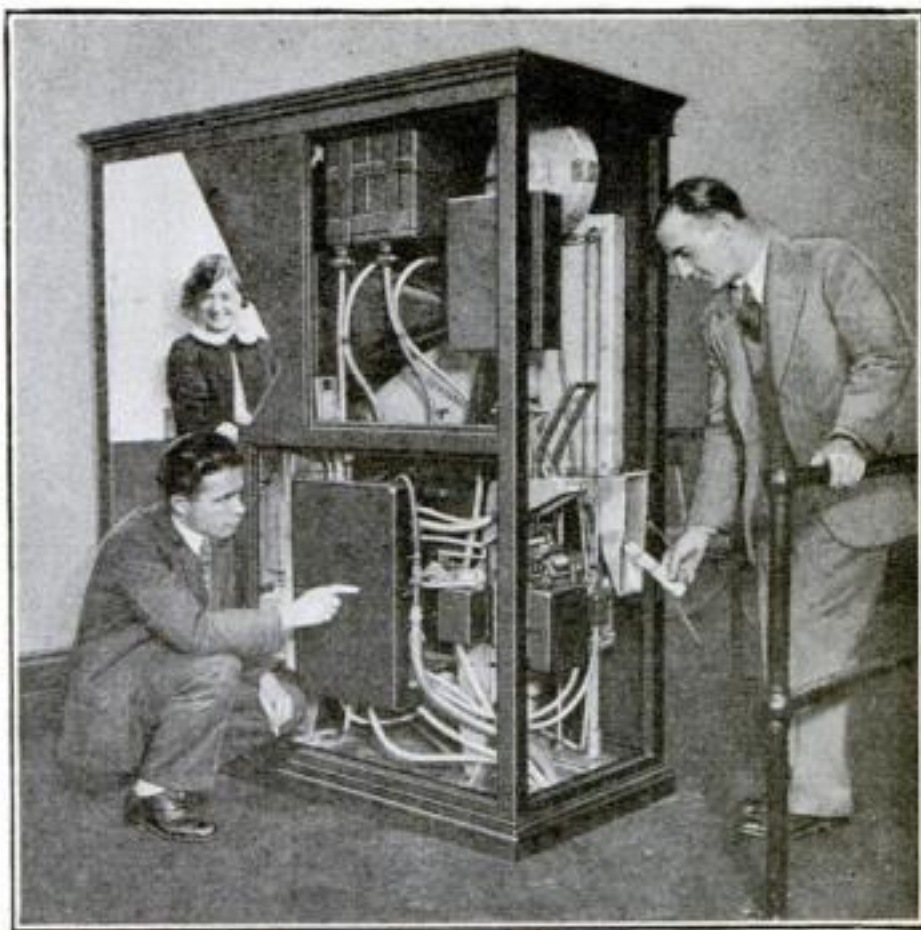
**T**WO body-strengthening features are incorporated in the new massage exerciser above, the invention of Alwin Kost, of Portland, Ore. While the reducing rollers on the massage cradle (inset, above) are getting in their work on chest or abdomen, the muscles of the arms, hips and chest are being exercised on the hand bar. The user swings from the hand bar while his chest, back, waist or hips rest against the massaging cradle. This in turn follows the movements of the body.

## Eight Minutes for Your Photo by Slot Machine!

**Y**OU step into what looks like an elongated telephone booth, seat yourself, assume your best smile, and drop a coin in a slot. There is a whirring sound, powerful lights flash on, a shutter winks. You step out of the booth and a few minutes later a finished strip of eight photographs of you is delivered at the other side of the machine.

Such is the new self-service photographic machine, called photomaton, invented by Anatol M. Josepho, of New York City.

What happens within the machine is this: The dropping coin closes a switch that starts an electric motor. Four 400-watt electric daylight bulbs are turned on. A strip of sensitized paper is fed into the camera by an ingenious roller that gives it a skip-stop motion, hitching it along with intermittent pauses. Synchronized with these pauses, the camera shutter opens and closes eight times, remaining open each time for one fiftieth of a second. Leaving the camera, the picture strip enters the developing solutions—



Cutaway model of the photomaton, or self-service photographic machine. Its inventor, left, is pointing out the inclosed switch-board panel; the man at the right is examining the finished strips of pictures; and the girl in the booth is ready for her picture. In upper right of the booth is the reel of sensitized paper

first the developer, then a bleaching solution, a clearing solution, and lastly the toner that gives the pictures their sepia color. Finally the pictures are squeezed to remove excess moisture, carried on a chain through an electric hot air dryer, and delivered as finished photographs. The entire process requires eight minutes. Enlargements can readily be made from the small photographs.

### Mechanical Driver Tests Balls

**A**BOUT the only way to find out if a golf ball was good, prior to the invention of the testing device below, was to play golf with it.

This device consists of a swinging club which operates automatically, hitting the ball with predetermined force. The person conducting the tests simply pulls a cord, thereby releasing weights which cause the club to hit the ball with a standard force. The illustration shows the position of the mechanical driver after hitting the ball.

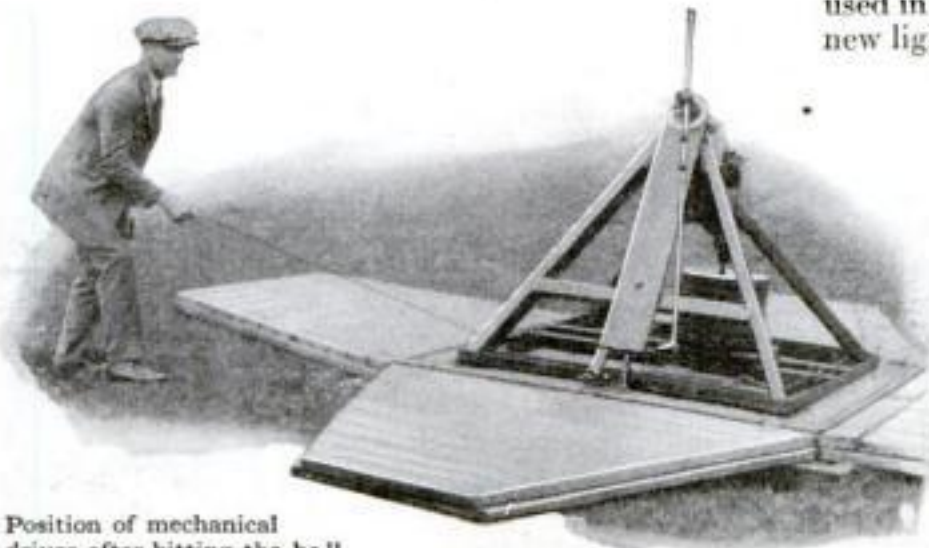
Since the force of the drive can be

predetermined and measured exactly, the operation is said to furnish an accurate test of a ball's balance, resilience and toughness.

### Aluminum Trolley Car Arrives

**T**HERE is one city in the United States, at least, where street railway officials will not admit that the street car is becoming a back number. That city is Cleveland, Ohio.

The Cleveland Street Railways have developed a new type of car which, by increased economy and efficiency, is expected to give busses and taxicabs a run for their money. The materials used in its construction are the new light-weight aluminum alloys developed for aircraft. The new car is nearly one fourth lighter than a steel car. As a result, less power is required to run it, and it can be started and stopped more easily and quickly. This means marked reduction in operating costs, part of which are due to the frequent stops.



Position of mechanical driver after hitting the ball



## Astronomers Check Up on Continental Drift



Part of world-wide radio net testing continental drift

ARE North and South America drifting hither and thither upon the bosom of the ocean? That is what astronomers suspect, and propose to find out, with the aid of such instruments as that illustrated at the left. Longitudes are checked with incredible exactness by this instrument, which compares local astronomical time with standard time signals received by radio, as part of a series of tests at San Diego in conjunction with stations at Algiers and Shanghai. Startling disclosures may result from these experiments, though the experiments may have to be repeated for several years, for checking-up purposes, before definite conclusions from the observations can be drawn. Seated at the delicate precision instrument is J. C. Hammond,

astronomer of the U. S. Naval Observatory, Washington, D. C. At the left is Dr. Frank B. Littell, professor of mathematics at the observatory.

## Paper Money from Tobacco Waste

DURABLE paper currency can be made from the waste cuttings and stems of tobacco, it is reported from Europe. The waste from tobacco factories is first treated by a chemical process to render it tough and pliable. It is then run through special machinery to cut it fine and is used as a substitute for the more costly waste linen rags.

## How Much Do You Know of the World You Live In?

TEST yourself with the following twelve questions, selected from hundreds of queries sent in by readers of POPULAR SCIENCE MONTHLY. The correct answers appear on page 142.

1. Where are the oldest trees in the world?
2. What is the usual path of storms across the United States?
3. Why do the Eskimos eat so much fat?
4. What ancient American people made human sacrifices?
5. Why might a dike between Florida and Cuba spoil the climate of England?
6. Where do ants raise mushroom rooms for their food?
7. Which is the greatest museum in the world?
8. Why are negroes sometimes called "Senegambians"?
9. Who built the first ships?
10. What are staircase farms?
11. What plant has the largest leaves?
12. What islands have the most unique vegetation?

## New Loudspeaker Fire Alarm

IN USING a new fire alarm recently installed in Birmingham, England, instead of pulling down a hook you speak



Left: New fire alarm closed. Right, showing the loudspeaker horn in the call box

into a mouthpiece connected to a loudspeaker in the fire station. Opening the fire box door automatically switches on the telephoning current. Through another loudspeaker in the box itself comes the amplified voice of the fire chief, asking where the fire is and telling you what to do until the engines arrive!

## Tool Grinder Uses New, Simplified Motor

TAKING a leaf out of the book of radio engineers, the manufacturers of this new tool grinder have produced an alternating current motor without special starting winding commutators or automatic switches. A condenser that is charged from the power line discharges the one coil in the motor. This is followed by the current directly from the line through the main coil, which draws the charged part of the rotor toward it.



Left: The new tool grinder in use. Above, the stator, showing the special coil arrangement



## Magnifying Lorgnette Saves Eyes

TO ELIMINATE one-eyed squinting through a magnifier to discern minute lettering on maps and drawings, army engineers have adopted these novel binocular "lorgnettes." When held before the eyes, they make the smallest details of aerial maps and photographs plainly visible.

Now the interesting possibility has been suggested of making stereoscopic relief maps that, when viewed through these glasses, will make high mountains stand out and valleys appear as sunken depressions.

In the photograph, Lieutenant J. M. Young of the Engineer Corps is seen using the new aid to the eyes.

## Invents Silent Railway Car

THE problem of engine vibration, it is reported, has been met and conquered by a Swedish railroad engineer, Magnus Tacklind, of Stockholm. He has designed a railway motor car said to attain a speed of fifty miles an hour with no more noise than the clicking of the rails.

The silent car has an underslung motor, entirely separate from the frame of the car. Power is supplied to the drive wheels from the motor by five distinct sets of gears, all in simultaneous use.

## Colored Movies Show Operations

MOTION pictures of surgical operations in natural colors have been obtained in Berlin, Germany. A three color process is used. Reflectors concentrate powerful light on the operating table. The camera is self-cranking, the electric motor drive being controlled by an operator who watches the progress of the operation through a telescope.

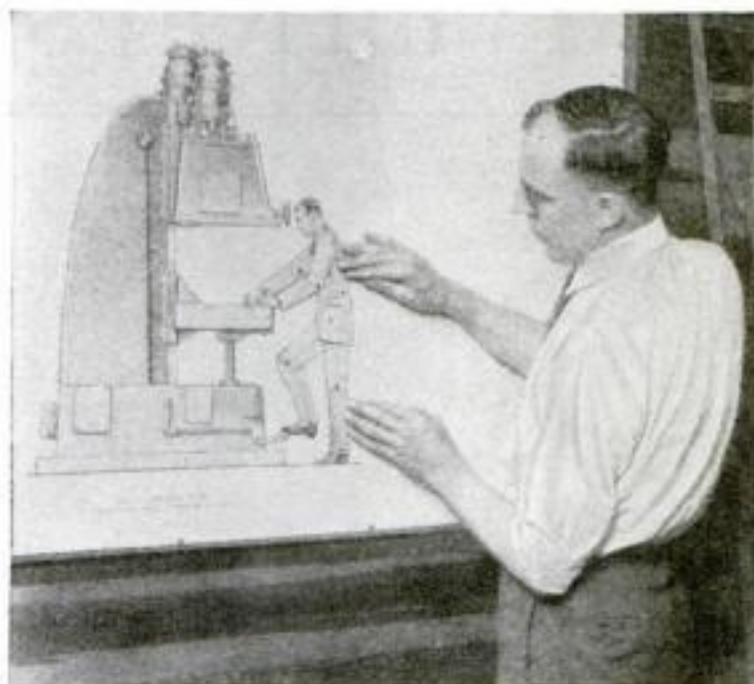


## Cardboard Doll Tests Machine Designs

**S**PECIAL machinery for use in the manufacture of telephones by a great Eastern company is now being tested, when still in the design stage, by cardboard dolls.

A cardboard doll with movable arms, legs and head, correctly jointed, has been carefully drawn to scale. It is made one fourth the size of the average man, as this is the scale to which most machine drawings are made.

In machine design, it is important to insure that the parts of the machine be convenient and accessible; to have the levers within easy reach, for instance, and sufficient head clearance. The manikin, placed upon the machine drawing, shows instantly how well a real operator can run the machine. By any other method, the design may be checked up only by actual operation or by tedious, time-wasting measurement.



Courtesy Western Electric News

Testing a machine design with the cardboard doll

The joints of the body have been scientifically located, for the figure must be made to bend forward and backward just as the real operator would do.

## Butter Churned While You Wait

**V**ARYING the time-honored method of turning cream into butter, a French inventor has devised a new machine to accomplish the same result mechanically.

In the device illustrated above, double pistons operated by the hand crank churn the mixture in the central chamber. A suction tube draws sour milk from a pail at the right, the flow of milk being regulated by a valve at the end of the intake tube. During the churning in the middle cylinder, butter is ejected as fast as it is formed, and is forced out through the small tube at the front of the machine into the pail on the left.

From 100 to 150 quarts of cream can be converted into butter with this device daily, according to the inventor. An electric motor can be attached to the machine, if desired, to eliminate the monotonous hand cranking.



The shaving mirror with built-in light—the bulb is behind the mirror, light being thrown up by curved white reflector

## Shaving Mirror Has Own Light

**F**OR the man accustomed but not resigned to shaving in poor light, the shaving mirror at the left offers the pleasant novelty of "a light that shows up every hair on the face." Light from a lamp concealed behind the mirror is reflected upward on the face, the lamp being thus safely shielded from the eyes.

## Homemade Boat Glides on Stovepipe Pontoons

**C**APABLE of being put together or disassembled in a few minutes, the odd-looking "glide boat" illustrated below is a new product of German invention.

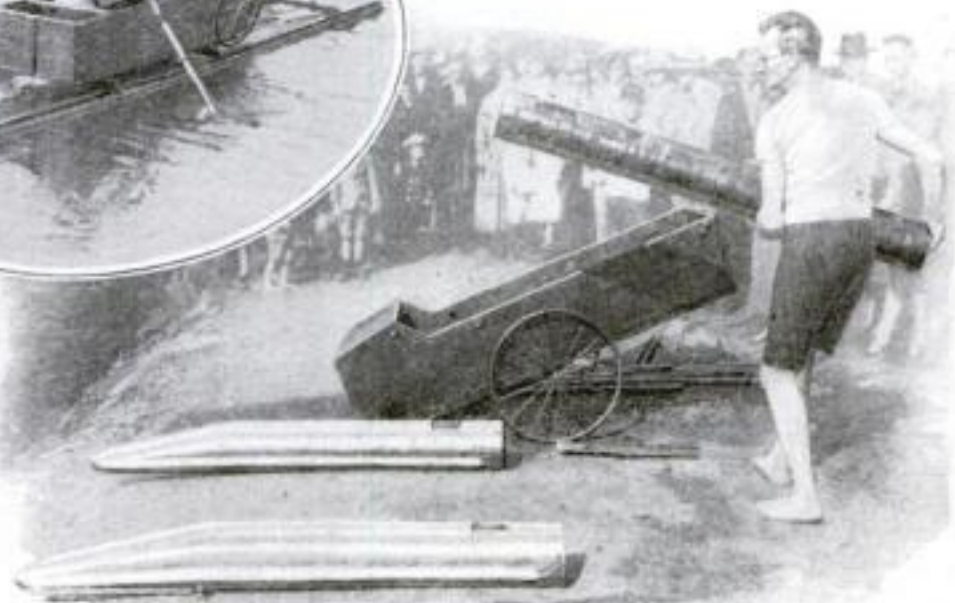
The craft is entirely homemade, even to the two pontoons, fashioned out of

stovepipe, that buoy it up. Ingeniously constructed out of odds and ends, it opens a new water sport to the pilot of the queer aquatic vehicle, who sits within a wooden box in the center and paddles himself about the lake or stream.

Five crosspieces, fastened across the two pontoons, insure rigidity in the water. The box is provided with two detachable wheels, so that the boat, when dismantled, can be wheeled from place to place on land.



Above: Inventor rowing his glide boat on a Berlin lake. Right: Putting the parts of the novel homemade craft together



## KNOW YOUR CAR

**T**HE wear on the average motor car is far more severe in winter than in summer, despite the fact that the car usually is run comparatively little in cold weather.

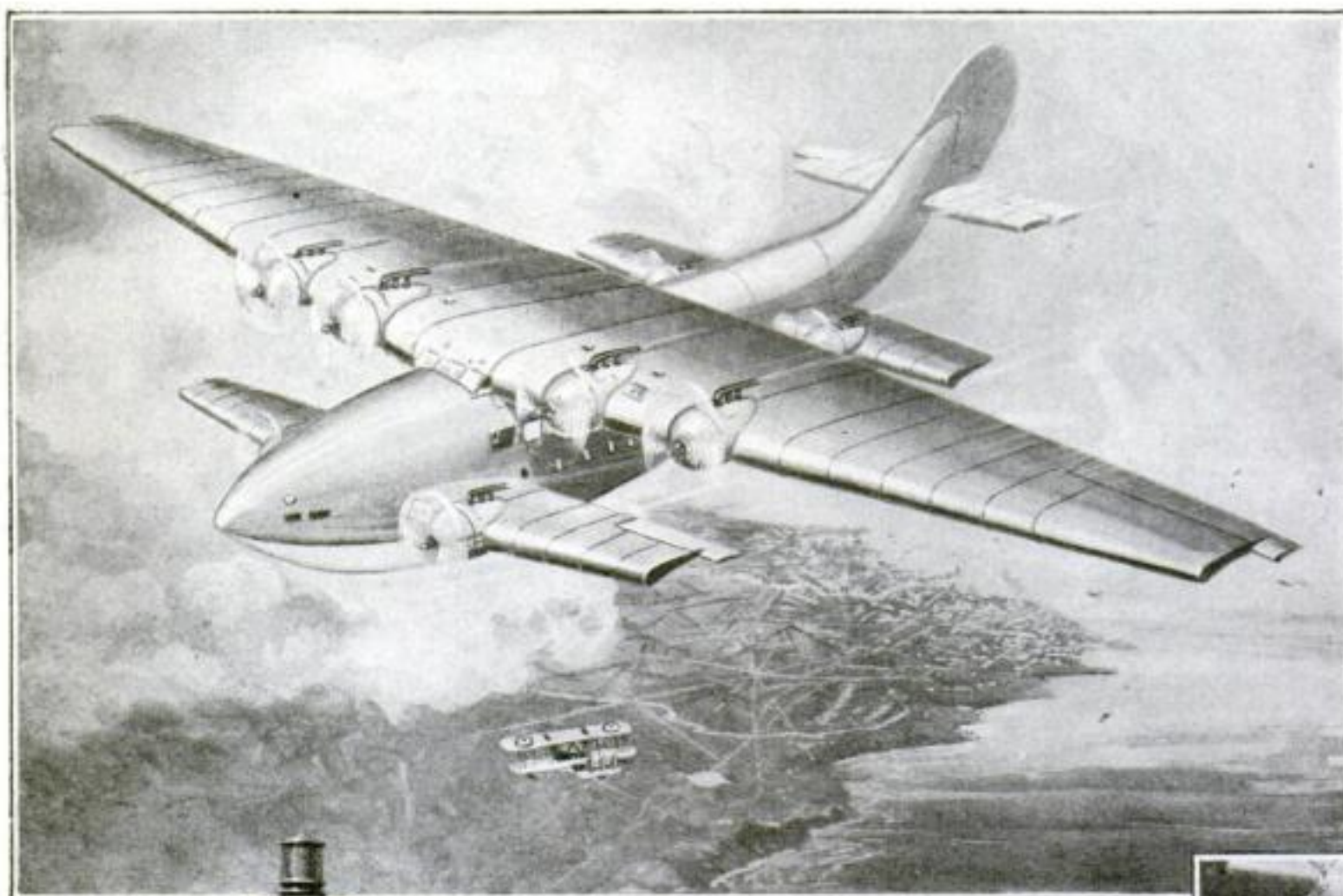
There are two main causes for this. One is that the choke must be used for several minutes in starting up because the motor is so cold, resulting in excessive crank case dilution and consequent poor lubrication. The other is that many owners do not cover up a portion of their radiators so the motor will warm up to normal summer temperatures. This also results in condensation of liquid gasoline on the cylinder walls, and so dilution of crank case oil goes on all the time the motor is in use. Carbon also forms rapidly in a motor run too cold.

Follow these rules during cold weather:

1. Use the choke as little as possible.
2. Let the motor idle slowly with the radiator covered up until it attains proper temperature.
3. Never race the motor idle or drive fast until the motor has had time to warm up.
4. Keep enough of the radiator surface covered up so that the thermometer will register summer running temperature.



# Aviation's Advances *at Home*

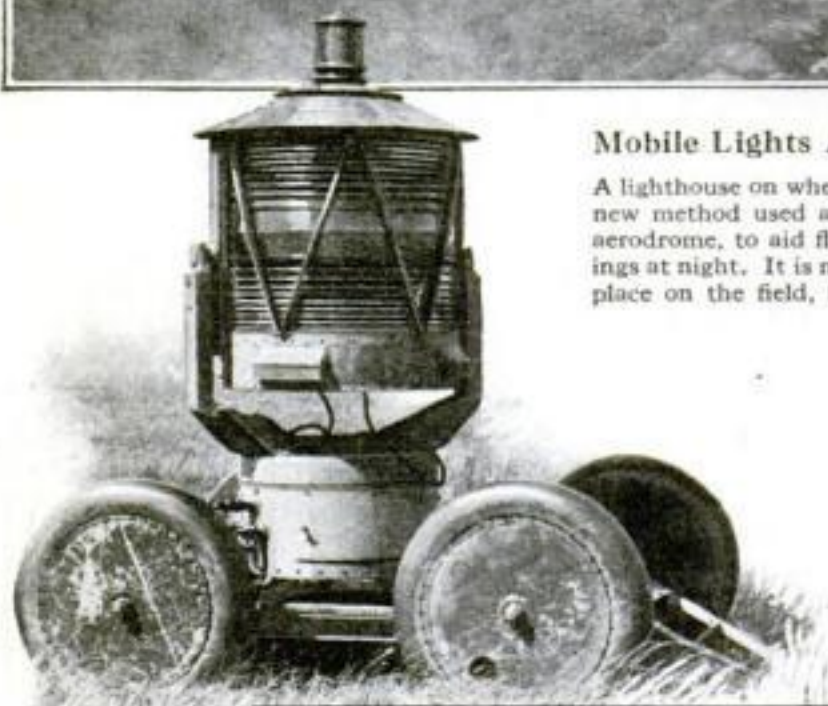


## Strange Air Liner for Ocean Hops

WHEN trips to Europe are made in airplanes as well as ocean liners, the craft that carries us may be of the type suggested in this drawing — an engineer's conception of a future trans-Atlantic air liner. A monster wing amidship, two smaller wings, all-metal construction, and eight motors, are features of the design.

Shaped like a giant flying fish, the craft would be 150 feet long and have an upper and lower deck

*Photo India Rubber World*



## Mobile Lights Aid Night Landings

A lighthouse on wheels, shown at the left, is a new method used at the Croydon, England, aerodrome, to aid flyers in making safe landings at night. It is moved about from place to place on the field, floodlighting a wide area



## Absorbs the Shock

Rubber shock absorbers are being fitted on some of the newer commercial planes. This device, shown in the upper left-hand corner of the photo (right) is a rubber cylinder carried on a telescoping strut joining fuselage and wheel

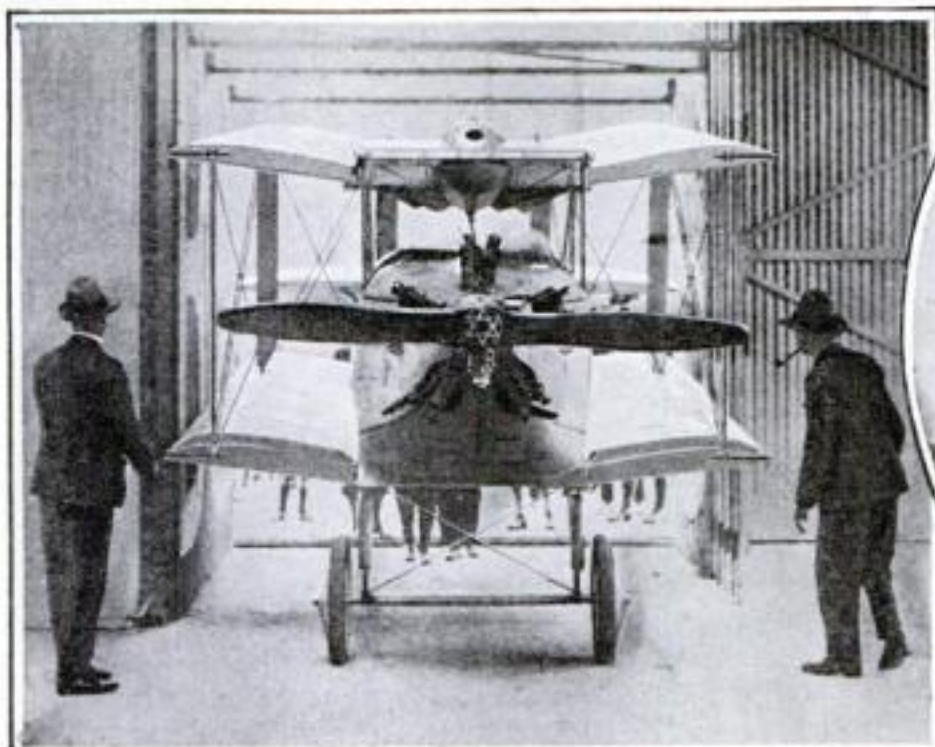


## Giant Flying Boat Has Five Motors

Completion of the monster seaplane here pictured, the largest in the world, by Chantiers Penhoet, France, marks a new epoch in commercial aviation. Two views are shown. Danger from engine failure is minimized by five motors. Within, the plane is divided into three stories, strikingly resembling an ocean liner

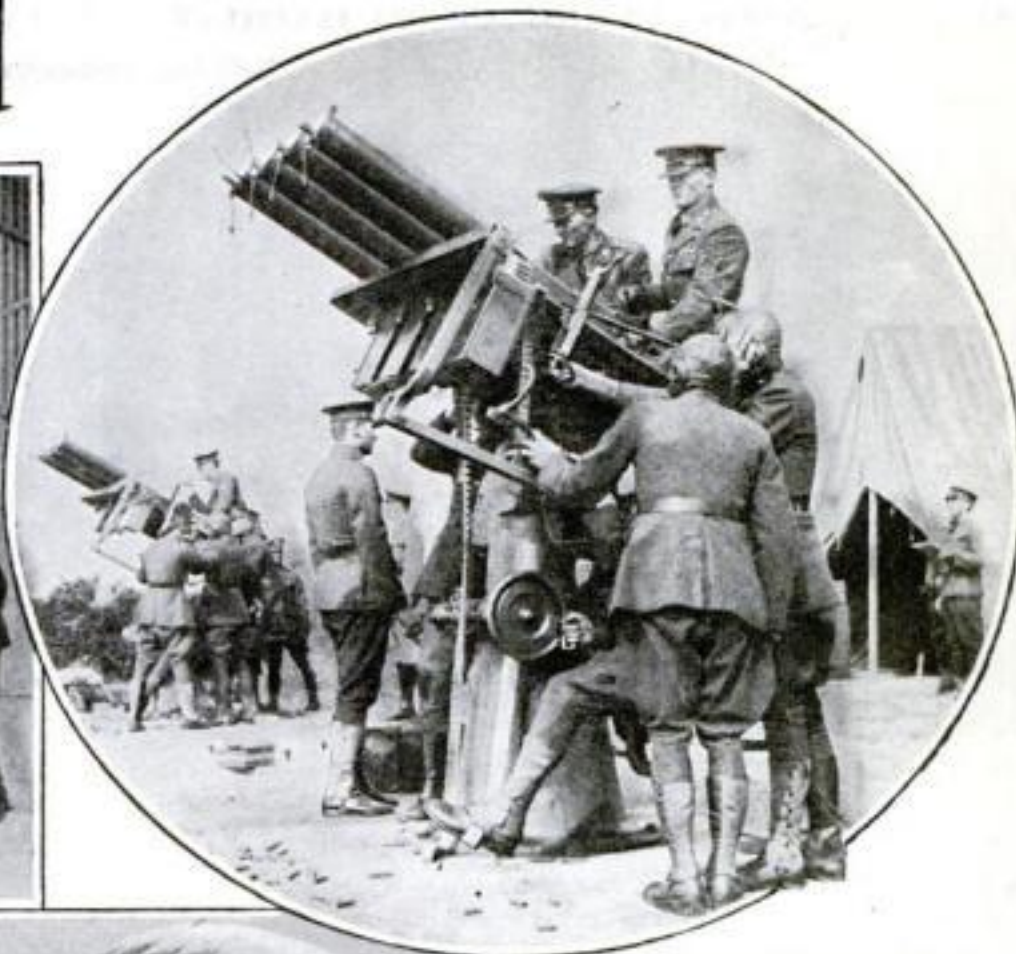


# and Abroad



## Fits into a Garage

A new British type of folding airplane, the Blackburn *Bluebird*, is shown above being wheeled from its hangar near London. The diminutive plane can be housed comfortably in a hangar scarcely bigger than an ordinary sized auto garage

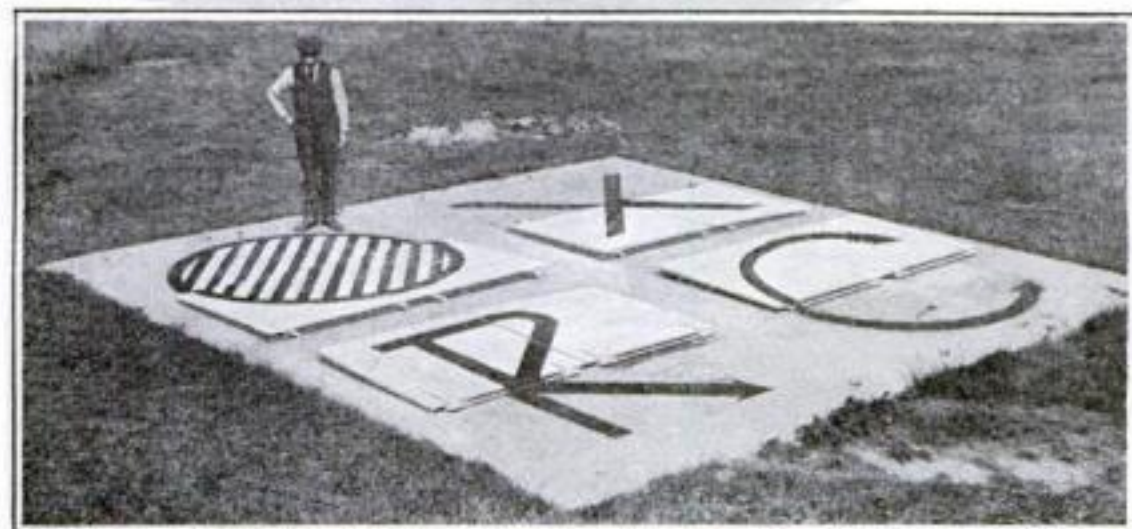
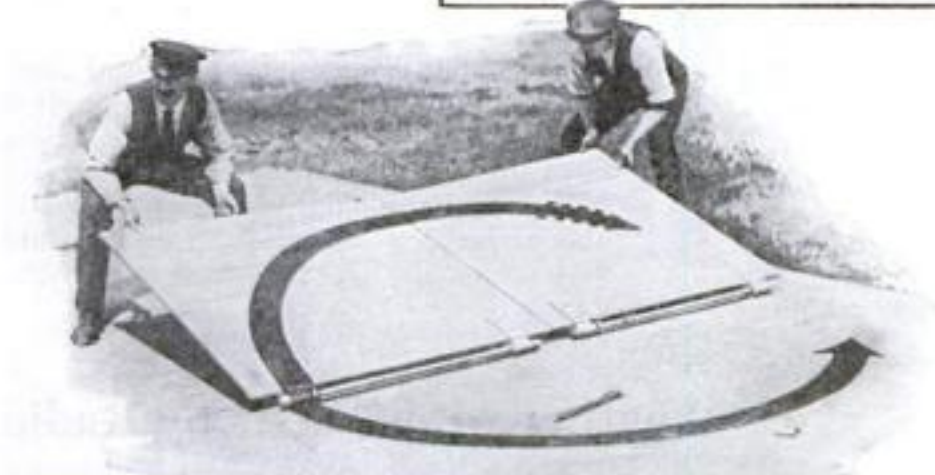


## Shoots Four at Once

The Army's newest anti-aircraft weapon, a multiple machine gun (above), fills the air with a leaden hail from four barrels fired as one gun. The photo shows a recent demonstration test at Aberdeen, Md.

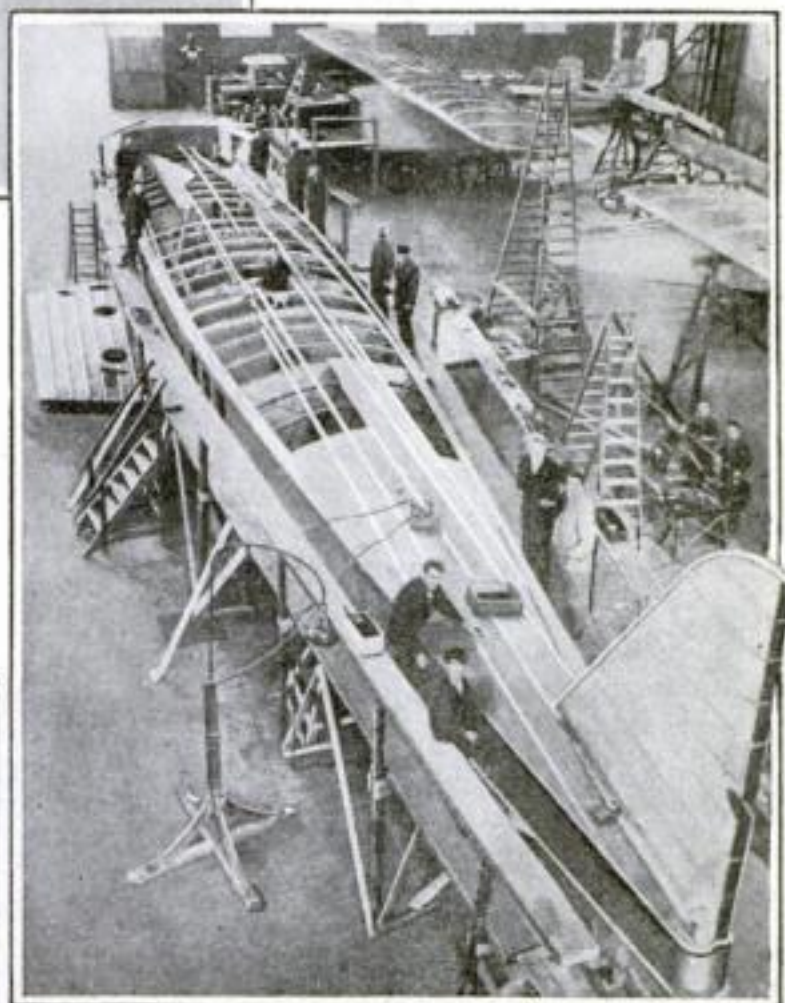
## Ocular Weather Signals

Weather conditions are signaled to British aviators by means of huge boards marked with symbols visible at high altitudes. The pictures below show the symbols used and how hinges permit the boards to be folded up. The symbol top left means rain; top right, snow; bottom left, thunderstorms; bottom right, gales.



## A Tricky Jump

(Left) Marine Corporal Archie Atherton, U. S. Naval Air Station at San Diego, Calif., making an amazing double-parachute jump. The giant sky parasols, 5,000 feet high, pulling with erratic force at the human atom between them, provided a thrilling spectacle for the hundreds of watchers below.

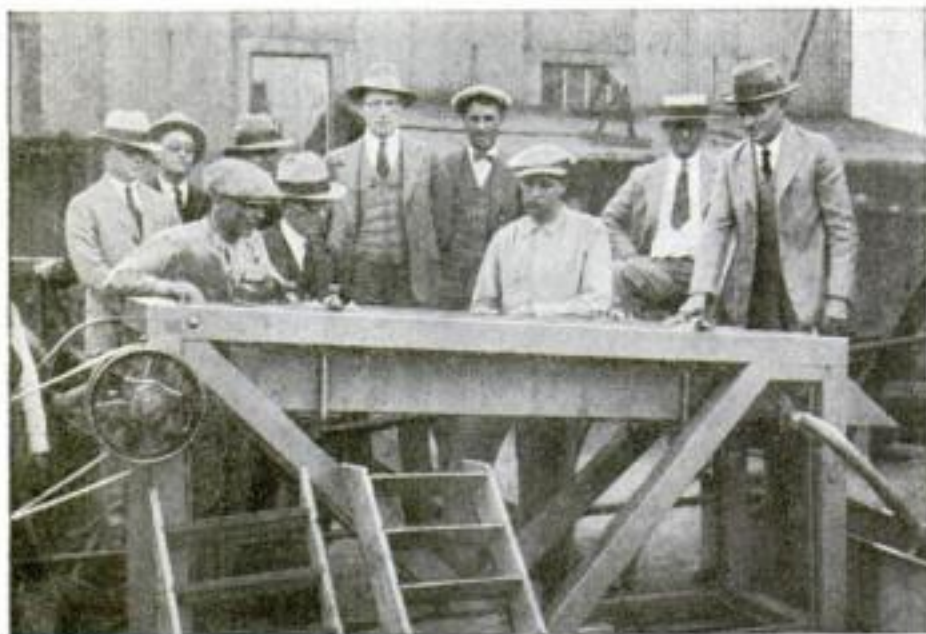


## Future Queen of the Air Lines

Workmen, above, are assembling the hull of what will be the world's largest air liner, having sleeping accommodations for thirteen passengers, now being built in Berlin. It will be seventy-five feet long.



## Miners Now Wash Gold from Sand by Machine

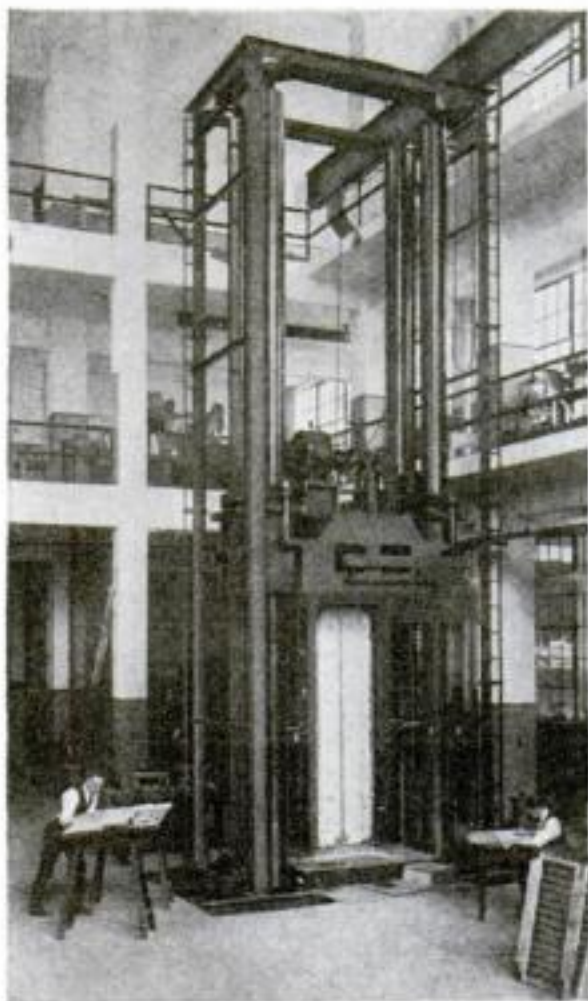


Modern miner's "gold pan," with its inventor, J. H. Ratcliffe, at right

### Could Crush Mightiest Girders

**SO POWERFUL** that it can crumple a huge steel I-beam as if it were made of cardboard, this Hercules of machines, at the right, the largest testing machine in the world, can exert a crushing force of 10,000,000 pounds! No conceivable stress to which a girder might ever be subjected could even approximate this force. The machine is used at the Bureau of Standards, Washington, D. C., for testing structural members, with the object of determining how much weight they can withstand without buckling. The results of the tests become a part of engineers' books of tables, to be used in designing towering structures of steel.

found. Mechanical agitation is provided. The photo shows the inventor, J. H. Ratcliffe, California mining engineer, demonstrating his remarkable device.



It's the biggest testing machine in the world



They pull up snugly over silk stockings

### Rubber Spats the Latest

**FLAPPING** galoshes are no longer the swagger thing in feminine winter footgear. Rubber spats that pull over the stockings, covering the whole leg, are a new offering of a thoughtful inventor. They button snugly.

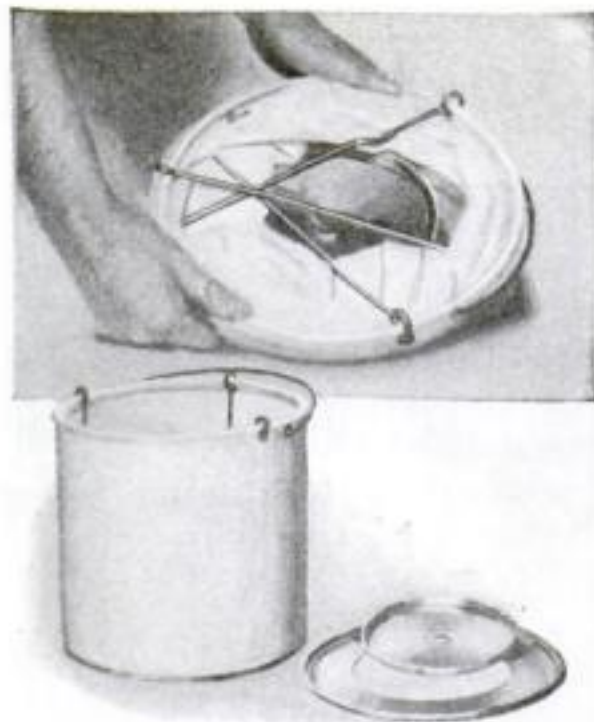
### Develop New Camera Film

**THE** invention of a new photographic film, said to be equally sensitive to all colors, is expected to bring about interesting changes in motion picture work. No more heavily plastered make-up may be necessary for the actors, and the director will be able to arrange the setting knowing that the scene will appear on the screen as it does to his eye. In color photography, as well, the invention promises to make possible motion pictures in perfect natural colors.

A REAL DOLL "vamp" has been created by a toy maker in Germany. The eyes and eyelids move in all directions in striking resemblance to human eyes.

**LIKE** the old miner's gold pan, which washed gold from sand and rock, is the concentrating and amalgamating machine pictured at the left—except that it's entirely automatic and adapted to the high-speed requirements of modern mining methods.

Water flowing down the sloping platform separates the gold from the sand and gravel with which it is



### This Water Pail Folds Up

**A** WATER pail as part of the portable equipment of the camper, fisherman or motor tourist, is possible now that one has been designed which folds into a flat, convenient size. As illustrated above, it has canvas sides, with a metal bottom and rods to keep it in shape when in use. The handle is also of metal. The top photo shows how compactly it can be folded together.

### Dry Hay while Sun Isn't Shining

**SUNSHINE** may no longer be a requisite in hay-making, with the invention by Arthur Mason, of Chicago, of a new crop-drying machine. In a recent demonstration, one hour elapsed between the placing of fresh-cut, green alfalfa in the machine and the removal of dried alfalfa meal in bags. The same process would have required at least two days with sun drying, and the value of the crop would have decreased from fermentation and depreciation.

The machine forms a mat of cut alfalfa eight inches thick and carries it on an endless belt through a hot air furnace that removes all moisture in thirty minutes. The interior length is about 150 feet. After drying, the crop goes through a chopper and is then raised into a loft by a mechanical blower.

Farmers are said to be enthusiastic about the new invention, which would make hay drying independent of the weather.

### Weather Maps Sent by Radio

**SHIPS** at sea may now receive not only radio weather reports but complete readymade weather maps as well, as a result of a new radio transmitting device.

This instrument, invented by C. Francis Jenkins, of Washington, D. C., includes a receiver with a recording stylus that traces in ink the curves of the map being transmitted from a land station. Rubber mats protect the delicate apparatus from shocks and vibration.



Receiving a weather map by radio. The photo shows the delicate receiving apparatus with the stylus which traces the map



## "Traffic As Usual" on a Moving Bridge



### Magnetized Checkers Stay Put

**N**ONSKID checkers containing small horseshoe magnets are the latest novelty for checker players. The checker board is steel, so the magnetized pieces can't slide while the game is being played. Kept in a steel box when not in use, the checkers are said to retain their magnetism indefinitely.

### Muffles Locomotive's Noise

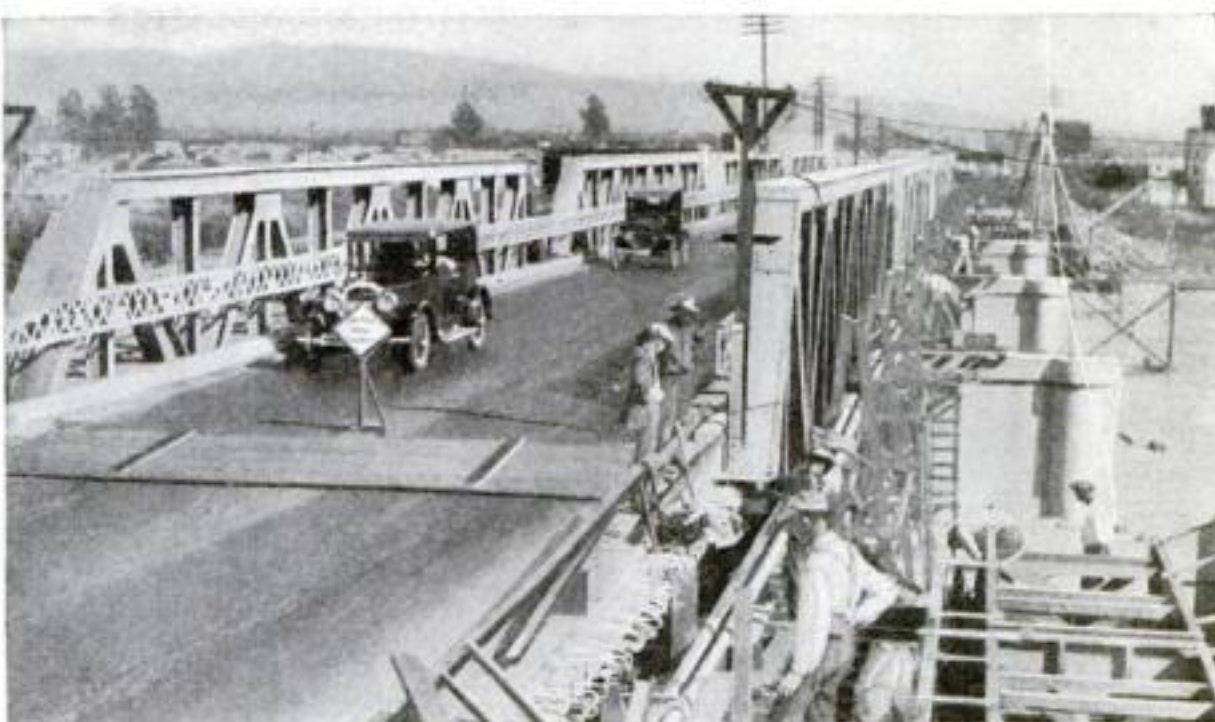
**L**OCOMOTIVES that glide along in peaceful silence are one miraculous result of applying the Maxim silencer, war-time muffler of firearms, to industry. Eight American railroad systems have installed silencers of special design on their oil-electric locomotives.

Placed on top of the locomotive, the silencer filters out the sound from the exhaust by a carefully worked out series of sound reflecting planes which do not interfere in any way with the escape of gases to the atmosphere.

### What Electrical Devices Cost

**J**UST how much do your electric appliances—toaster, iron, and so on—cost to operate? A specially constructed test board was installed recently in a Montreal, Canada, department store to answer this question. When the appliance under test is plugged into the board, as shown in the photograph at the right, a dial shows the rate of consumption in amperes. Another dial registers the watts. The line voltage is shown on a voltmeter between the two dials. The scale of costs per 100 watts appears on one of the cards at the side of the board. Another card gives the actual cost per hour in cents and fractions, at the local rate.

A comparative test in candlepower of the lamp bulbs on the lower part of the test board is given by the "vaness" under the switch plates.



**W**ITHOUT disturbing the normal flow of automobile traffic in the least, California engineers have succeeded in moving into place a new 6,000-ton bridge to take the place of the existing structure. When the old bridge at Montebello, just outside of Los Angeles

on an important intercity highway, had been prepared for speedy removal, the new span, already assembled, was pushed into place with powerful jacks. Motorists drove unconcernedly across it as it slid on steel rails to its permanent position, as shown in the photograph above.



Testing the current consumption of an electric hot-plate. Note the dials that register the power needed to operate various electrical devices for the home

### Chases Fog for Aviators

**F**OG is dissipated by high-voltage electricity from a new apparatus tested by government engineers, intended to make landing fields safe for aviators. A path 1,000 feet high and 2,000 feet wide, it is said, can be cleared by the machine. The device throws upward a blast of air charged with electricity, which, meeting the fog, precipitates it as rain.

### Versatile Saw Run by Motor

**O**NE feature of handy cut-off saw at the right, a new addition to labor-saving machinery, is that the weight of its electric motor keeps the swinging saw arm out of the way when not in use. When work is to be done, a convenient hand lever pulls forward the whirling blade and slices off any desired length of lumber with swiftness and precision. Power is supplied by an electric motor that takes its current from any lamp socket.



It saws wood, leather, fiber, even steel tubes

A versatile tool, the saw trims two by fours to size, and cuts metal tubing, bakelite, brass rods, leather and fiber.

### Prehistoric Beasts in Plywood

**R**ECENTLY a series of plaster models of prehistoric creatures was made at the Natural History Museum, London, and from these, designs were made for an unusual set of small models to be reproduced in plywood. The models offer an excellent means to study the strange dinosaurs and mammoths that once roamed the earth, and many schools, particularly schools for the blind, have already adopted them for instructional purposes.

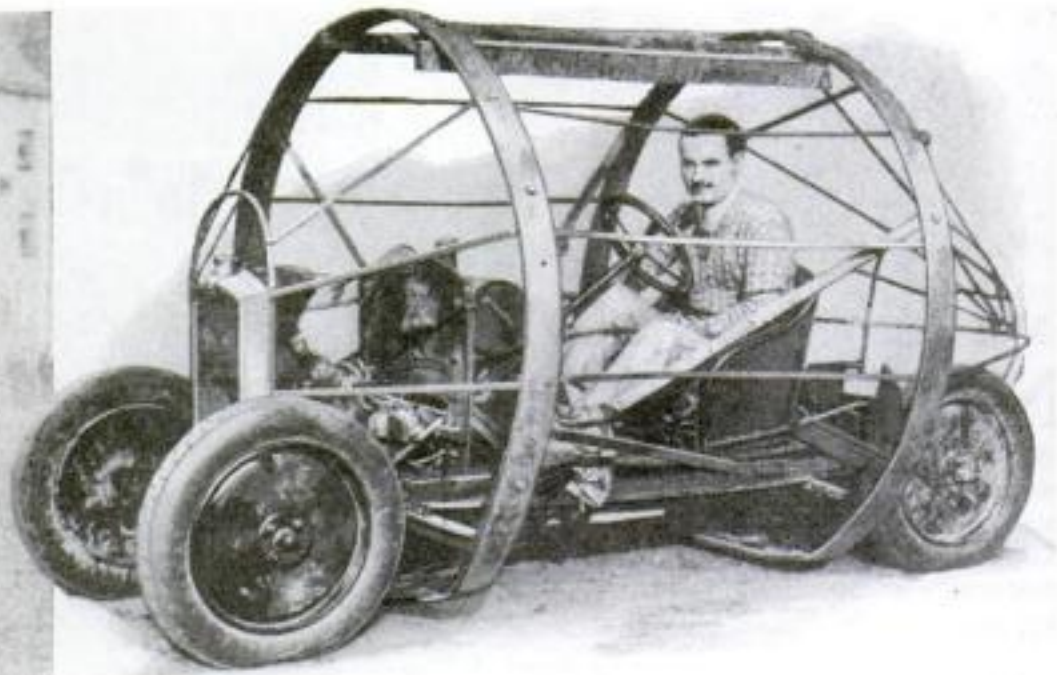
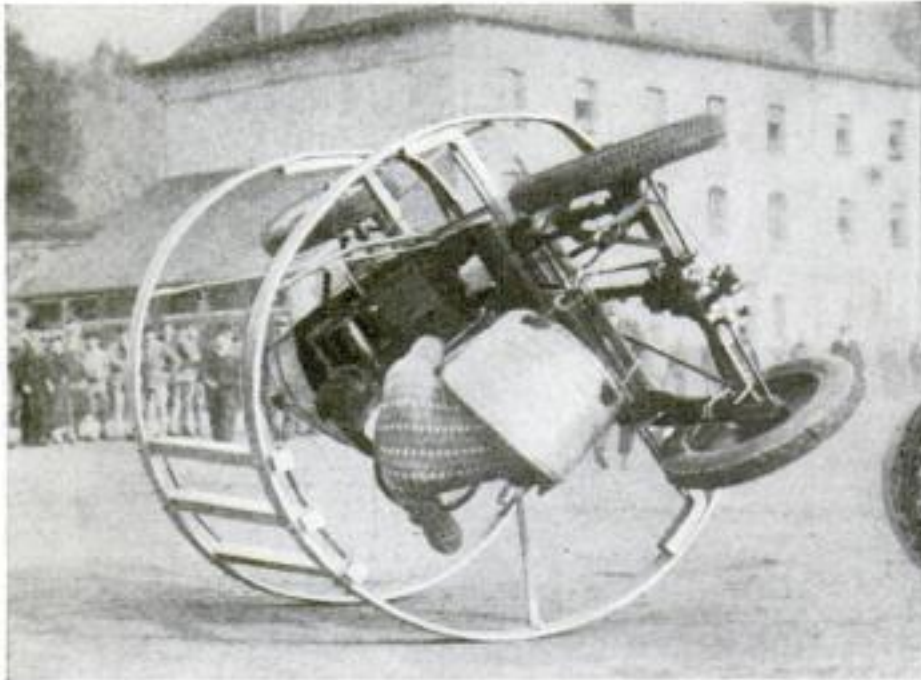


This weird-looking animal is a diplodocus. The model is one of a unique series depicting prehistoric beasts

**THREE CARRIER PIGEONS** were defeated by an airplane in a strange race recently between Hammondsport and Auburn, N. Y., an airline distance of fifty miles. The plane beat the first pigeon to arrive by three minutes.



# Acrobatic Auto Rolls Over Sideways, Even Loops the Loop



**T**HE audacious young automobilist, rolling along upside down, above, is Andre Mercier of Paris, France, and the vehicle with which he defies death is a little five-horsepower European motor car

completely inclosed in a heavy steel cage. Not particular about which side up he lands, Mercier makes his extraordinary machine stand on end, roll over the ground, or loop the loop at will, by

putting on the front wheel brakes while driving at top speed. This capsizes the car, which then rolls over and over on the sturdy metal hoops that inclose it, and finally comes to rest undamaged.

## New Harvester Fights Corn Pest

**S**PECIAL harvesting machinery designed to end the reign of terror in Ohio's farming territory of the European corn borer, evil genius of the "corn plague," was tried out extensively in recent months in the infested areas. Since the pest hibernates in the base of the stalk, the harvesters are designed with extra low cutting blades to cut the stalk close to the surface of the ground leaving no stubble. The borers are thus removed with the stalks, to be crushed in the husking process. The low cutting is said to reduce materially the size of the next year's brood of corn borers.



## Hawk Nests on Telephone Pole

**M**YSTERIOUS leaks and cross-talk on a New Jersey telephone line were traced finally to the hawk's nest above. Made of driftwood and seaweed, the nest is impregnated with salt. In wet weather the salty moisture allowed current to flow from one wire to another.

## Goggles for "Aviator's Blindness"

**W**HEN Commander Richard E. Byrd flew to the North Pole last spring, the glare of the sun's rays reflected from the limitless expanse of dazzling snow gave him an acute case of snow-blindness. Even in ordinary flights, aviators' eyes suffer strain from light reflected from below, reaching their eyes at an unaccustomed angle and falling on a part of the retina that is little used to strong illumination.

To relieve eye strain incidental to flying, a new type of aviator's goggles is being developed at the Brooklyn Navy Yard and Rockaway Beach, N. Y. The problem is to produce an eyepiece of the highest optical perfection, to eliminate the danger from imperfect or distorted sight, fatal to airmen, and at the same time to shade the eyes from the most injurious light rays.

It is expected that the glass used will be yellowish-green in color, this tint absorbing a large proportion of the harmful light without materially dimming vision.



Even the nose provides space for a sign

## Odd Roadside Sign

**A**RMED, hat, even the nose and suitcase of the fantastic figure at the left, carry warnings and directions for motorists who pass this strange signpost erected at a crossroads in Castine, Maine. The figure is made of wood, painted white, and seldom fails to attract tourists' attention.

## Phantom Dance Uncanny—If You Don't Look Close

**A**LL the vogue in London, "phantom dancing" has recently struck the United States. You'll find it uncanny, unless you know the explanation. The dancers go through their steps perfectly and in exact rhythm, but no music is heard.

Fitted over the dancers' bobs, however, are radio headpieces. They are stepping to radio music which cannot be heard by the persons watching them.



Dancing the Charleston to phantom music—the "musician" using dials

## Hydrogen Turned into Helium

**T**HE remarkable feat of changing hydrogen into helium, for use in airships, is reported by two professors of Berlin University, Germany. The process as described consists of the rearranging of the individual electrons within the atom, paring off the unnecessary ones, fine particles of metal causing this reaction merely by their presence.





### New Speed Typing Like Printing

**T**YPISTS who have all they can do to manipulate the forty-odd keys on the ordinary single alphabet typewriter may groan at the thought of a keyboard with 1,160 letters and forty alphabets. But this seemingly complicated keyboard on a remarkable new typewriter invented by Fred A. Dolph, of Washington, D. C., was designed especially to make writing easier and faster.

Each alphabet lies in a single vertical line, as shown in the picture above, and each line has three shifts, for capitals, characters, and release. The operation is simply to press down the desired keys, from left to right, the forty rows across. To space, it is merely necessary to skip a key. Then when an entire line is "set," a lever is pressed, which prints the line.

### Crushes Mountains of Ore

**A** NEW gyratory iron ore crusher has just been completed for use in the Michigan ore fields, which can handle 2,000 tons of stone in an hour and crush the rock to nine-inch size. It is the largest ore crusher ever built, and its entire weight is over half a million pounds.

### Mother Hears Baby, Upstairs, by "Radio"

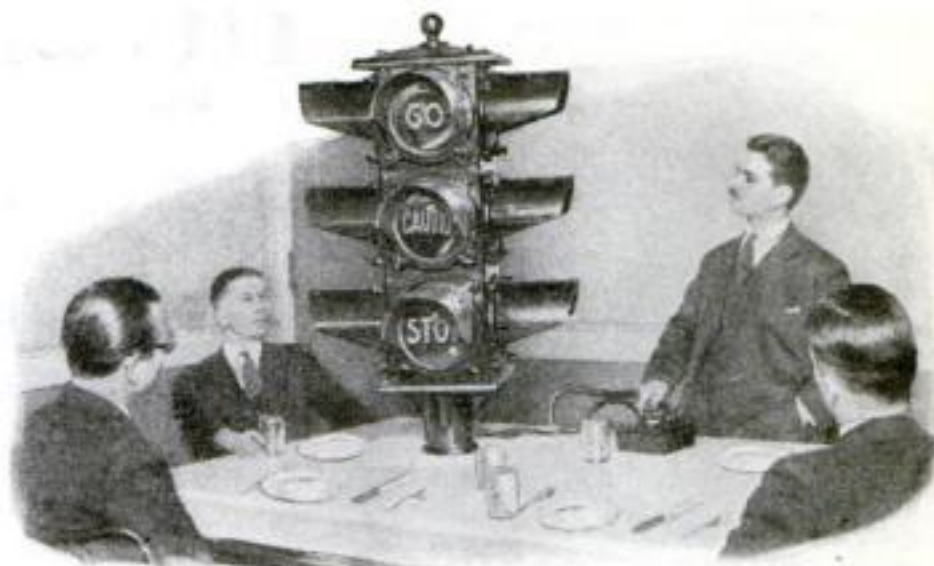
**W**ITH the aid of an ingenious application of radio apparatus, devised for her by Frank Lester, of New York City, Mrs. Benjamin N. Fishman, of Richmond Hill, N. Y., can keep as careful a watch over her sleeping baby, while seated comfortably on the front porch, as though she were upstairs.

A microphone hung on the side of the baby's crib is wired to an audio amplifier which operates a loudspeaker on the porch, transmitting the first waking wail of the sleeper or any other warning sound.

The loudspeaker may be moved to the

**W**ITH a broad hint on the banquet table like the device illustrated at the right, after-dinner speeches may lose their terrors and listeners may be reasonably sure that the speaker will not stretch his two minutes to twenty.

A green light signals "start talking"; amber, "time's nearly up"; red, "stop—moreover, sit down." With warnings so impersonal and so unmistakable, daring is the man who dis-



regards them. Electrical engineers made this unique use of an electric traffic signal at a recent banquet.

### A Master Whittler's Triumph

**W**HITTLED almost entirely out of wood with a pocketknife, the remarkably complete working model of a locomotive illustrated at the left is the work of Edwin Nunn, of Cincinnati, O.

It is a scale model, equipped with all modern improvements and in complete working order, even to the air brakes, which also function practically and are the only parts not made of wood.



Edwin Nunn, pocketknife expert, with the model of a locomotive he made. The air brakes are the only parts not made of wood

### Giant Squash Weighs 115 Pounds

**O**NE thousand pumpkin pie enthusiasts were provided with one piece each of their favorite delicacy when this enormous specimen was handed over to the pastry cook after being exhibited at San Leandro, Calif., recently by William Faustina, who raised it. It was all one man could do to lift the squash, which weighed 115 pounds.



This pumpkin made two hundred pies

kitchen, to the laundry or to any other room where the mother has to be for some time, permitting her to work undisturbed, knowing that, as long as the loudspeaker is silent, the baby is sleeping.



The microphone, or sending unit, is attached to the crib (above). The baby's cries are transmitted through it to the loudspeaker (left), which can be moved to any room desired



### How Colored Lights Affect Us

**N**EW discoveries about colored lights and their effect on human efficiency may have an important application in the illumination of factories and offices. In recent tests conducted in Vienna, it was found that under yellow light we see printed letters more accurately; under blue light, more quickly.

In the experiments, the persons tested looked at letters printed on cards, like the cards used by oculists. Four lights were used—white, yellow, red and blue. All had the same intensity. More letters were identified under the yellow than under the other lights. However, when only a brief glimpse of the cards was permitted, the best identifications were made under the blue lights.



# Inventions to *Lighten*

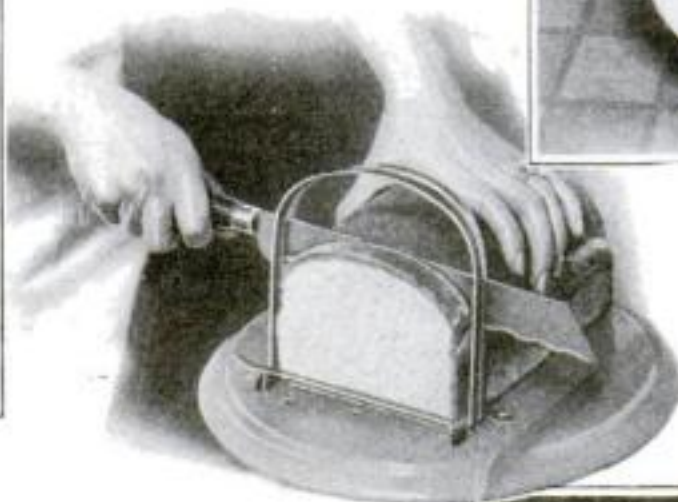


## Puts Power in the Washtub

Stand the queer-looking tube above in a laundry tub and a jet of water will issue from the perforations in the bottom, powerful enough to wash the clothes. It is the newest idea in electrical washing machines.

## Every Slice Alike

Every slice of bread is cut straight and with machinelike evenness of thickness, with the new bread-cutting outfit shown below. A slot between two upright metal loops guides the bread knife. At the bottom a stop can be set for any thickness.



## All the Scrubber Needs

Soap and brush go with this handy housecleaning pail above, contained in individual holders attached to its base. The built-on basin catches any dirty or soapy water that happens to run down the outside of the pail.



## A Non-Grease-Spattering Broiler

In the ingeniously designed broiler above, grease runs down a funnel-shaped false bottom through a hole into the pan below, thus preventing the nuisance of spattering and the danger of grease catching on fire.



## Saves Sore Knees

She who scrubs floors will appreciate the comfort of soft cushions in this new scrubbing coaster above. Rolling smoothly on ball bearing casters, it is upholstered to fit the knees.



## For a Neat Job at Egg Separating

It's easy to separate eggs with an aluminum separator that fits into a glass or cup (above). Whites run off through slots, while the unbroken yolks of the eggs remain in the separator.



## Nightrack

A hanger for your coat, another for trousers, and hooks for all the remaining articles of a man's attire, keep them in shape overnight on this handy rack, above. Even shoes are hung from hangers fastened to tiny chains.

## Bath Stool Becomes Shoe Shine Box

A touch is all that is required to have this shoe shining apparatus (right) sink slowly down out of sight. The top may then be closed, forming a handy stool for the bathroom.

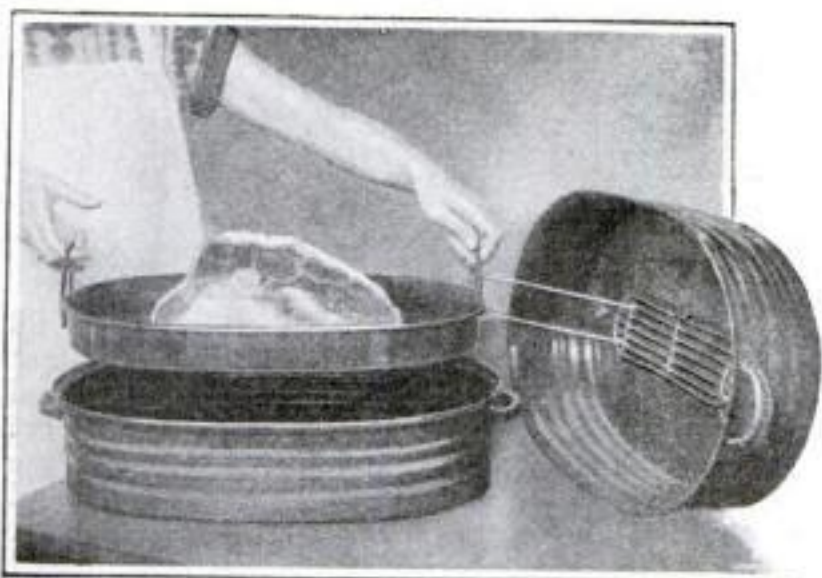


## Speeds Up Window Washing

The window-washing tool below contains a pad of felt which wipes away the dirt and grease. On the reverse side is a strip of rubber which wipes the window dry and clear.



# Household Tasks



## Needs No Basting

The unique roaster illustrated at the left is self-basting. Steam from the cooking meat condenses on the top and drips down; or slices of bacon may be placed in the rack on the cover, and their drippings add to the flavor of the meat.

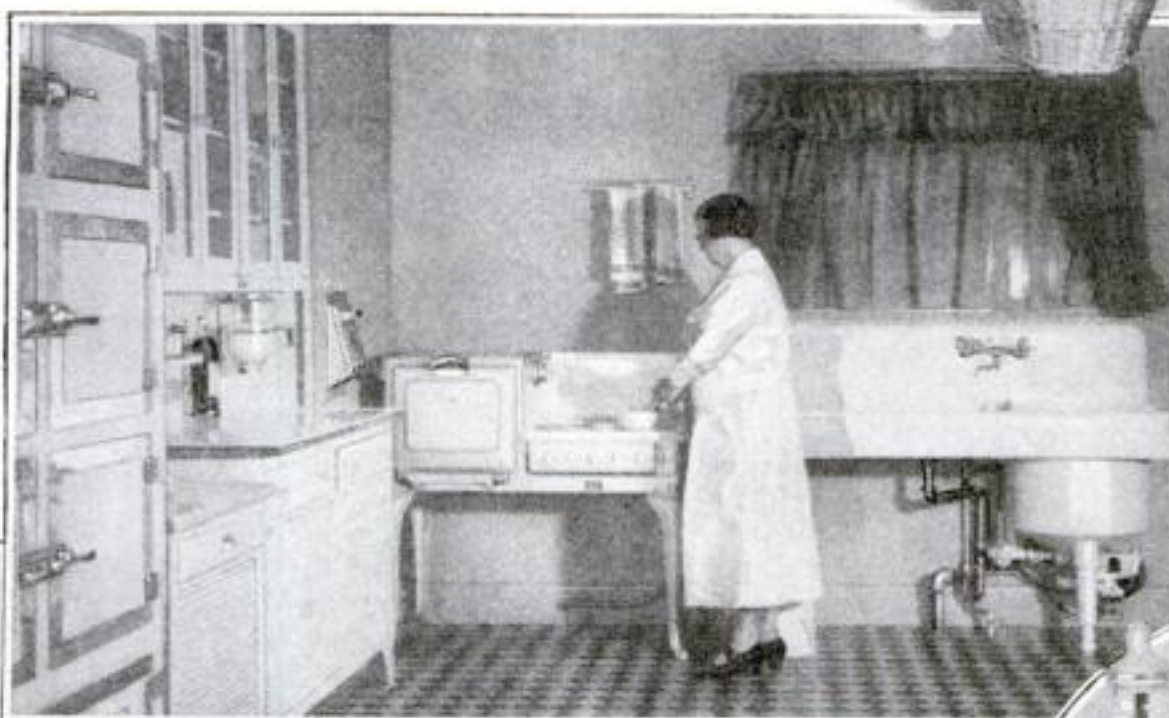


## Dries Wash Indoors on Rainy Days

Whether the sun is shining or it's raining pitchforks outside, the week's wash can quickly be dried in the gas-heated laundry dryer illustrated above. A thermostat that automatically turns down the gas when the air gets too warm, making scorching impossible, is an interesting feature.

## A Labor-Saving Kitchen

Right: A typical electrically equipped kitchen of the modern housewife. Note the electric range, sink with built-in electric dishwasher, electric refrigerator—a whole retinue of servants at the pushing of a button!—besides the kitchen cabinet and refuse chute to incinerator.



## Waxes and Polishes

Easily reversible, the weighted block of the floor waxer above has felt for applying the wax on one side, and cheesecloth for polishing on the other. Thus no changing of cloths is necessary in using.



## This Garbage Pail Drains Itself

The bottom of the removable inner pail of the refuse receptacle at the left is perforated to let liquids escape into the larger pail, lessening the danger of clogged sinks. The entire aluminum receptacle swings conveniently from a clamp attached to the sink drain.



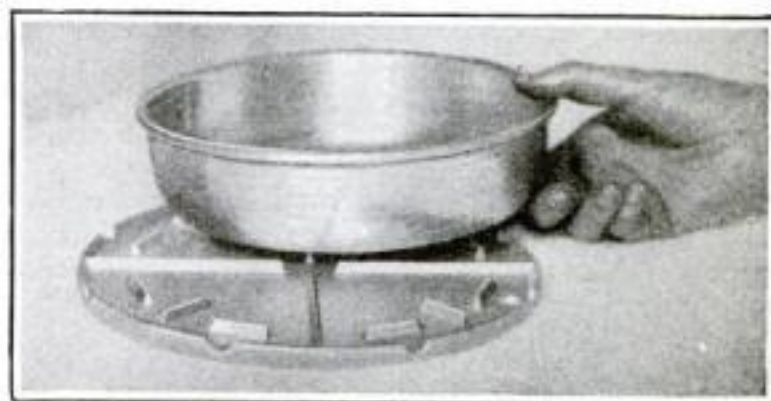
## Toothbrush Hygiene

At the bottom of each of the novel glass toothbrush containers above is a pink charge of sterilizer that keeps the brush fresh and free from germs.



## Pot Scraper Does Double Duty

With a rubber blade at one end and a metal one at the other, this little scraper (left) does its after-dinner job with double efficiency. The rubber end is for plates, the metal for cooking pots and pans.



## Aluminum Plate Subs for Double Boiler

Food won't burn when it is cooked over this ridged aluminum hot-plate, says the maker. It keeps the cooking utensil from direct contact with the flame.



# How to Hook Up a Radio Set

*With the Right Kind of Equipment,  
Carefully Installed, Your Receiver  
Can Be Made a Marvel of Simplicity*

By ALFRED P. LANE



## It's Child's Play

Although receivers and accessories are constantly becoming more complex and highly developed, the actual operation of an up-to-date receiver is so simple that even a small child can tune it

**T**IMES have changed as far as radio installations are concerned. It is no longer good form for the man of the house to install a radio receiver that has a dozen or so complicated control knobs, and then make matters worse by connecting up the batteries and other accessories in such a way that no one in the family can figure out how to run the set.

Curiously enough, the actual use of a radio receiver has been steadily growing more simple, even while the receivers themselves and the accessories that go with them have become more complex and highly developed.

In spite of the elaborateness of the modern radio installation, its control can be made so simple that practically any of the present-day models are easily tuned by any member of the household, including the children. However, these desirable results can be obtained only if the installation work is carefully done and if the accessories that go with the set are capable of rendering good service for long periods of time without attention.

The temptation to buy an expensive set and then skimp on the other necessary parts of the equipment is responsible for a great deal of trouble. If, for instance, you have decided to invest \$200 in radio receiving equipment, it would be better to buy a \$150 set and spend the rest on high class accessories than to buy a set for \$175 and then try to run it with \$25 worth of inferior accessories. The same principle applies, of course, regardless of the total amount involved.

**S**UPPOSE you buy a standard five-tube radio receiver of any make or price. This receiver will come to you carefully packed in a carton to protect it from injury. Inside the carton you will find nothing but the set and an instruction book. Before you can get the set into operation you will need all of the following accessories:

A set of high grade vacuum tubes consisting, for best results, of four standard type tubes and one of the new power tubes.

A six-volt storage battery to run the tubes, called the A-battery.

A storage A-battery charger.

A set of dry cell B-batteries or a B-battery eliminator.

A loudspeaker.

Antenna equipment.

If your decision is in favor of the B-battery eliminator instead of the dry cell B-batteries, another piece of equipment will be found well worth while. That is an automatic switching relay to turn the B-eliminator on and off and control the trickle charger as well.

A diagram of a complete installation, showing all of these items, appears on the opposite page.

Your dealer will be glad to help you in the choice of good equipment for your set, but the decision as to what to choose necessarily depends largely on what kind of results you expect and how far you are willing to go in the matter of expense. On some of the equipment there is considerable latitude, while on other items there is practically none. Take vacuum tubes as an example. The best grades are only slightly more expensive than the "bootleg" variety, and there is no comparison between good tubes and second rate tubes as far as long life and full volume are concerned.

**S**TORAGE batteries, on the other hand, are made in a wide variety of styles and at different prices. All of them are rated in ampere hours, and you can figure that your five-tube set will run approximately two thirds as many hours as the rating of the battery expressed in ampere hours. But if you buy a trickle charger which will keep the battery fully charged at all times, the capacity is of little importance. In fact, if you buy a trickle charger it is desirable to purchase a small capacity battery, because the internal losses will be less and so will the purchase price. A battery of about forty to sixty ampere hours is large enough for any five-tube or six-tube set under these conditions.

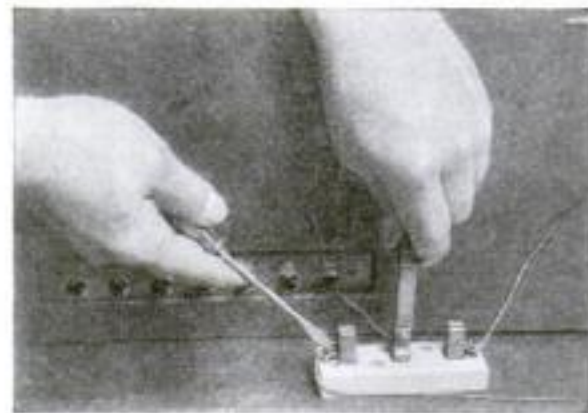
It will be up to you to decide between a set of dry cell B-batteries and a B-eliminator. The dry batteries will be cheaper to start with, but the B-eliminator will be cheaper in the long run, particularly if you use the set for many hours a day on the average.

Perhaps the most important item of all is the loudspeaker. You can get one at almost any price, from \$5 up to \$100, and if you buy a reliable make you will get your money's worth anywhere along the line. It is all a matter of tone quality and volume. Your own ear will have to decide.

Antenna equipment has been placed last on the list because the antenna you can erect, and consequently the material you will have to buy, depend entirely on your location. An antenna of some sort will be necessary, of course, unless you purchase a loop-operated set.

**Y**OU may, for instance, be living in a city apartment where no outdoor antennas are permitted. In that case a half pound of ordinary bell wire, costing about thirty cents, strung around the picture molding, will give the finest kind of indoor antenna. On the other hand, you may live in the country where a long outdoor antenna is possible, and you will need antenna wire, insulators, lightning arrester, ground connection, and possibly a pole from which to string the antenna.

Constantly keep in mind the fact that you want your installation to be suitable for use by any member of the family. This means that it must be made absolutely fool-proof as far as the visible portions of the equipment are concerned. You can have a regular power plant with all the gadgets and trick switches you want, provided it is inclosed in a cabinet, placed in a near-by closet, or stowed away in the cellar so that the members of the household will have nothing to do but turn one switch and turn the dials to the desired station. An installation such as shown in the diagram will give you exactly this result. Everything except the set can be placed out of the way where you can give it periodic inspection and



## For Two Antennas

If you wish both indoor and outdoor antennas, this single-pole double-throw switch is the simplest arrangement. Connect the antenna binding post of the receiver to the center terminal of the switch, and the antenna wires to the remaining terminals. Then you can throw the switch to either



attention. When the switch on the set is turned on, the current flowing through the automatic relay turns off the trickle charger and turns on the B-eliminator so that the set is ready to use. When the switch on the set is turned off, the current flowing through the relay is cut off too, and it snaps back to its original position, shutting off the B-eliminator and putting the trickle charger to work again.

The illustration, for the sake of clearness, shows all of the accessories as separate instruments. You can buy them in this way or in several different combinations. The storage A-battery and the trickle charger may be combined in one case, or you can buy a B-eliminator that includes the trickle charger for the A-battery and the automatic relay. Of course, any of these combination outfits will simplify the wiring job.

**T**HE attention required to operate such an outfit is almost negligible. You don't have to test the battery with the hydrometer every so often to see if it needs recharging. In fact, all that is needed is an occasional inspection to make sure that everything is working properly, and additional supplies of water at intervals for the storage battery and for the trickle charger if it happens to be of the liquid type. When you wind the clock on Sunday you can form the habit of spending a couple of extra minutes inspecting your radio equipment. Forget it completely the rest of the time.

Of course you cannot expect fool-proof service from your radio equipment unless you install it carefully. Slipshod connections and loose, dangling wires are bound to cause trouble in time. If you have the power supply accessories in a closet or in the cellar, for instance, make sure that the wires are fastened down wherever they are visible.

**I**N MANY localities, especially where there are a number of local stations, it is desirable to have both an outdoor and an indoor antenna. The outdoor antenna will be useful to bring in semidistant and distant stations, and the indoor antenna will be fine for receiving the local broadcasting, particularly when the static is heavy or there is a thunderstorm in progress. The simplest arrangement to avoid loose wires is to use a single-pole double-throw switch, as shown in the illustration on page 58. Connect the antenna binding post of the receiver with the center terminal of the switch, and connect the wires for the two antennas to the remaining terminals of the switch.

The question frequently arises as to how far from the receiver the power supply units and the loudspeaker may be placed. As far as the loudspeaker is concerned, it may be placed at almost any distance from the receiver without diminishing the volume or affecting the quality. The B-battery eliminator or dry cell B-batteries also may be placed at any desired distance from the set, provided the wires from them are bunched together. Sometimes a steady squealing noise is produced

## What You Need for Radio Satisfaction

1. A good receiver.
2. High grade vacuum tubes.
3. A reliable storage A-battery.
4. A storage A-battery charger.
5. Large-size dry cell B-batteries or  
A dependable B-battery eliminator.
6. Dry cell C-battery.
7. A true-toned loudspeaker.
8. Correct insulation.
9. Periodic inspection.

when the B-batteries or B-eliminator are placed many feet away. A squeal of this kind always can be stopped completely by connecting  $\frac{1}{2}$  or 1 mfd. by-pass condensers between the B-battery binding posts of the set. Make sure that the condensers you buy for this purpose are capable of standing the voltages without breaking down. Connect a condenser from each of the plus-B binding posts to the minus-B binding post.

The storage A-battery should be placed within six feet of the set unless you use heavy wire to connect it. In most cases it is not necessary to put the battery more than twenty or thirty feet from the set. For this distance use wire not smaller than No. 12 gage.

While radio vacuum tubes are now sold at reasonable prices, you will want to know how to make sure that you don't burn them out through an error in connecting up the power supply units. The best way to do this is to run the wires from the binding posts of the storage battery to the binding posts of the set before you do anything else. The red binding post on the battery must be connected with the binding post on the set that is marked plus A. If you are installing an automatic relay, one binding post of the

relay should be connected with the remaining terminal of the storage battery and the other terminal of the relay should be wired to the minus-A binding post on the receiver. Next put all the tubes in the sockets and turn on the switch on the set. If the tubes light and there is a slight click from the relay each time the switch on the set is turned on or off, you can be sure that your hook-up is correct up to that point.

**B**E CAREFUL not to get the battery terminals reversed, as the set will not operate, although the tubes will light and the relay will click.

Radio fans who have used dry cell B-batteries are often confused when they attempt to connect a B-battery eliminator for the first time. The binding posts on the eliminator should be connected with the binding posts on the radio set that are marked the same way. If it happens that there are more binding posts on the eliminator than there are on the set, connect the binding posts on the set with the similarly marked ones on the eliminator and leave the remaining posts on the eliminator unconnected.

After you have the eliminator hooked up, snap the electric light plug of the eliminator into the socket in the relay that is marked B-eliminator. Next connect the trickle charger with the storage battery, making sure that the red, or plus, terminal of the trickle charger is connected with the red terminal of the storage battery, and then snap the plug from the trickle charger into the socket provided for it in the relay. Then you can snap the plug from the relay into the nearest electric light socket.

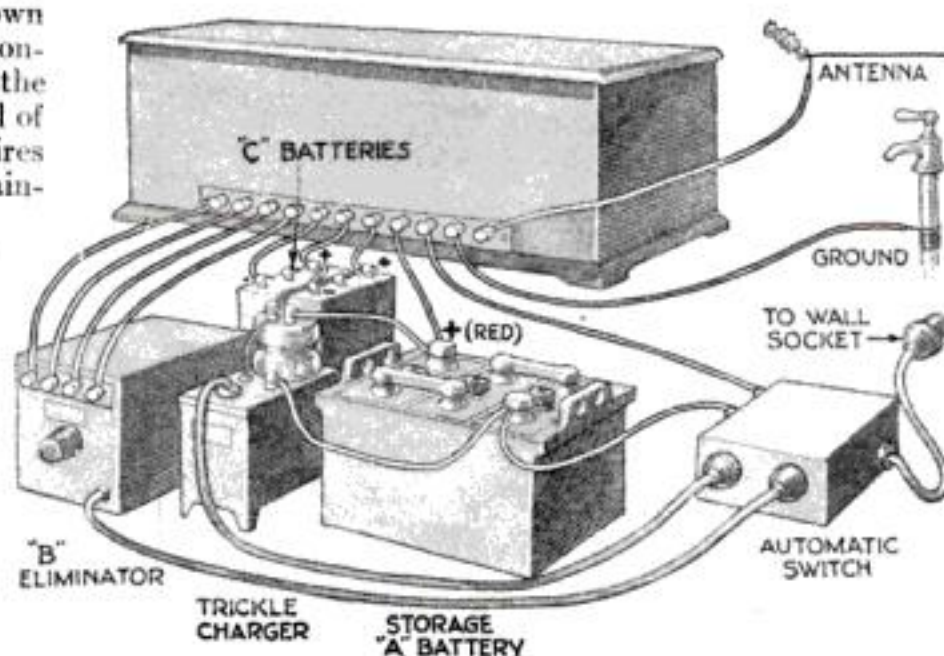
**R**UN a wire from the ground binding post of the receiver to the nearest cold water pipe. It is desirable theoretically to have this connection short, but actually it makes little difference whether you connect with a water pipe right beside the set, or with one in the next room.

There is no mysterious art required in putting up a good radio antenna. All you need is a metallic wire from the antenna binding post of your receiver about 100 feet long and as high as local conditions will permit. Make sure that it touches nothing except an insulating material, from the free end to the binding post of the receiver.

In putting up the average outdoor antenna, three insulators are used. One is placed at each end, and a porcelain tube insulator is usually employed to carry the wire through the wall.

Local conditions govern the type of antenna to erect. You may not be able to put up an antenna 100 feet long. In that case put up as long a one as possible. Reception of distant stations will not be so good, but a short antenna will be just about as good as a longer one for the local and semi-distant stations.

Careful attention to the details of a radio installation will insure you continuous service without trouble or expensive service calls.



**An Installation That Needs Little Attention**

A complete installation which will give you the simplest operation and most satisfactory results. All the wiring connections are indicated. In actual use the battery, charger and B-eliminator are hidden elsewhere.



# What a Bargain Radio Did to Me

As told to  
NEWTON BURKE

"HENRY! Just read this wonderful bargain!" exclaimed the wife enthusiastically. She folded the evening paper to indicate the advertisement that had caught her eye and passed it across the table.

"Humph!" I grunted noncommittally. "I thought you said you didn't want a radio. What's so marvelous about this one? Seems to have the usual number of gadgets on the front, as far as I can see."

"But it's a special sale, Henry, and they give you all the batteries and loudspeaker and everything free!"

The ad did look appealing. I'd been thinking about getting a radio receiver for some time. Here was a chance, I thought, to get the whole works without having to do a lot of shopping around; and if there was any prospect of holding the money out of the family budget for a radio set, now was the time. Hadn't the good wife suggested it herself?

I stopped at the store next day on my way home from the office. They had a set on demonstration. It looked pretty good to me. And the salesman explained that the tone quality would be much better in my own home because, he said, the store didn't have the proper acoustic qualities.

He brought out a long form printed in very small type which he said was the standard sales contract, and I signed it.

The next night my wife was waiting for me at the door of our apartment when I came up on the elevator.

"It's here, Henry!" she greeted me. "The radio is all ready and I'm just crazy to have you get it going. The man told me how to start it, but I was afraid I might break something. Please start it right away!"

She wouldn't even give me time to take off my coat. I sat down in front of the shiny new outfit and reached for what appeared to be a switch. My guess was right, for music could be heard faintly from the loudspeaker. I turned the dials back and forth until I had the music good and loud. But my wife held her hands to her ears and her face registered keen disappointment.

"SOUNDS kind of sour," she protested. "It certainly does," I replied. "Maybe it's a little green like a sour apple and it will get ripe and mellow after we use it a while."

We let it remain turned on during dinner, and about the time we reached pudding and coffee the music suddenly stopped.

I walked over to investigate. The switch hadn't snapped itself off. I tried it to make sure, and then lifted the top of the cabinet to see if I could find the trouble.



*It Cost Me More in the End  
Than an Expensive Set, in  
New Parts and Service Bills*

## The Worst Was the Sounds It Made

When my wife first heard our wonderful "bargain set," she thought its tone quality terrible. But we got used to it and finally didn't realize ourselves how tinny it was, until our friends joshed us into hearing a good set. Then we canned our bargain junk.

"That's funny," I said. "One of those lamp things seems to have gone out."

There was no more radio that evening, and the next morning I called up the dealer. He carefully called my attention to the fact that radio vacuum tubes were not guaranteed and explained that sometimes they did burn out very quickly. I told him to send up a new one. It cost two dollars.

THE next night the set worked all right, and every night after that for a week. Then another tube burned out. I had it replaced. Three days later a third tube passed on, and about that time I decided that radio was a pretty expensive amusement if I had to spend from two to four dollars a week for new tubes. I also decided that some other dealer might have tubes that wouldn't burn out so quickly, so I wrapped up the latest casualty and took it to a small radio dealer near my home.

"Where'd you get the alleged vacuum tube?" he inquired as soon as he had opened the package.

"It came with the set I bought," I replied.

"I thought so," he said. "That's what they call in the trade an 'equipment tube.' I suppose you want a good one now."

"Five of them, please," I answered. "I might as well have them handy when the rest go out."

My soreness over the vacuum tubes was just beginning to die out a week later when right in the middle of an interesting program the music began to get weak.

I turned the volume control up a few notches and brought it back to the proper level. After this happened a couple of times I turned the volume on full, and then I had to sit there and listen while the music got weaker and weaker and finally died away altogether.

"Now what's the matter with your fine radio set?" my wife inquired disgustedly.

"How should I know?" I returned peevishly. "I'm no radio expert and it looks like the fellow who put this thing together wasn't one either."

I raised the cover again. While the tubes were lighted, they seemed to be glowing very dimly. I shut it off and phoned the dealer.

"It's your A-battery run down," the service man suggested.

"Should it run down that quickly?" I asked in surprise.

"Sure, you ought to have a charger," he answered. "We have some very good ones for \$16.95. Shall I send one up?"

"I thought this was a complete outfit I bought," I snapped. "You needn't bother to send up any charger. I'm stung bad enough now." And with that parting shot I hung up the phone and called on the local dealer again.

The set worked all right for a month after that, and then the music and voices began to get weaker and weaker and mixed up with scratching noises. I called in the local dealer, and learned that the B-batteries were dead.

"These are 'equipment' batteries," he explained. "They aren't much good to start with, and besides that the set isn't wired for a C-battery, so it takes more current than it should. You ought to have the large-size batteries anyhow."

I TOOK his advice and had him put in a set of large-size batteries, but my troubles had only begun. The loudspeaker went on the bum and had to be fixed. Then the set went dead and one of the transformers had to be replaced. All of these things were replaced free by the firm from which I had bought the set, but the joker turned out to be a bill for "service calls" at the rate of three dollars each!

I might still be contributing to the support of that concern if some friends of ours hadn't joshed us unmercifully about the rotten tone quality of the set even when it was working right. My wife and I had sort of got used to listening to its tinny music, but one evening we went around to the local dealer and he gave us a demonstration with a good set. We hadn't realized that radio could be so perfect, and the set he demonstrated is now installed where the bargain junk used to be.



# Hints for Radio Beginners

## If Sleet Coats Your Antenna—

*Rig Up a Sash Weight to Prevent Breakage—Locating a Hum—Other Helps*



This type of joint will stand as much strain as a continuous wire. Be careful not to nick the wire with the pliers

**W**HILE it always is a good idea to use a single, continuous piece of wire for an antenna or for the lead-in, you may want to use some short lengths to make up a temporary antenna or to piece out an exceptionally long one.

Twisting the wires together in almost any fashion will do as far as getting electrical contact is concerned, provided that the twist is tight; but more care than that must be taken if the joint is to stand the strain produced by a severe windstorm or by sleet deposited on the wire.

The illustration above shows the best way to make a joint that will be as strong as the wire itself. Note that several easy turns are followed by sharp turns in such a way that the pull does not come at a point where the wire has been weakened by a sharp bend. In making a joint of this type, the pliers should not be used except to clamp down the tip end of each wire as shown. The reason for this rule is that pliers put nicks in the wire and if a break occurs it takes place at the nick.

A joint made in this way, and that is subject to continual strain as in an antenna, offers little resistance to the flow of either high or low frequency electric current until it has become corroded with age. It is always better to flow solder into the joint so that it will not lose its electrical conductivity. The joint should be strong enough to stand the pull, however, without relying on the strength of the solder.

**T**HE most severe test to which any radio antenna can be subjected is the weight of a heavy deposit of sleet. The strain or pull on the wire depends to a considerable extent on how tightly it is stretched, and it is good practice to loosen up on the antenna and let it swing in a deep curve whenever a sleet storm threatens. A way to rig your antenna so that this will be taken care of automatically is shown in the diagram at the bottom of the page. The only extra material you need is a small galvanized iron pulley and a sash weight. As the sleet begins to collect on the antenna wire and increases the pull, the antenna will sag

and the sash weight will be lifted. When the sleet melts the weight will pull the antenna back to normal position. The length of the antenna will determine the amount of weight that will be needed to keep it taut.

### What Causes the Hum?

**S**O LITTLE hum is produced by the modern type of B-battery eliminator that it is barely perceptible if you hold your ear close to the loudspeaker when no signal is tuned in. Sometimes, however, the step-up transformer in the B-eliminator will produce a slight hum that has nothing to do with the radio receiving circuits. In fact, it is exceedingly difficult to produce an alternating current transformer that is absolutely noiseless when operating at full load. The noise is produced in the transformer by the vibration of the thin sheets of iron that make up the core.

The way to find out whether the slight hum you hear is coming out of the loudspeaker or is produced in the B-eliminator is to disconnect the antenna while the set is in operation. If the hum continues, you may be certain that it is not in the electrical circuit to the loudspeaker. You can muffle the hum produced in the B-eliminator by placing the instrument in a near-by closet.

### There's No Cure for Fading

**T**HE causes of "fading" have been discussed by electrical scientists and several theories have been evolved to account for the phenomenon, but up to date no remedy has been discovered. If you are bothered by the signals alternately becoming weak and then strong again while you are listening to any station that is more than twenty-five miles away, and you have tested to make sure that the trouble is not due to a loose or defective connection in your set or battery wiring, you can rest assured that any other set of any make would produce exactly the same effect if it were used in your location. Do not waste any money on de-

### A B C's of Radio

**N**INE tenths of the trouble calls, so the radio service men say, are caused by dead tubes or exhausted batteries. A large proportion of the difficulties remaining after these two sources of trouble have been eliminated can be traced to loose wires. Another big percentage is chalked up against difficulties for which the radio equipment is not to blame, such as static or the interference from some form of electrical machinery.

If your set produces queer scratching or buzzing noises, disconnect the antenna and see if the noises continue. If they stop, you may be sure that there is nothing wrong with your set. If they continue, look for a loose connection in the battery wires or a tube prong that is not making perfect contact with the spring in the socket.

When your set goes dead, test the B-batteries, then the A-battery; after that, if necessary, take your vacuum tubes to a reliable dealer who can test them for you. By following these suggestions you may avoid expensive service calls.

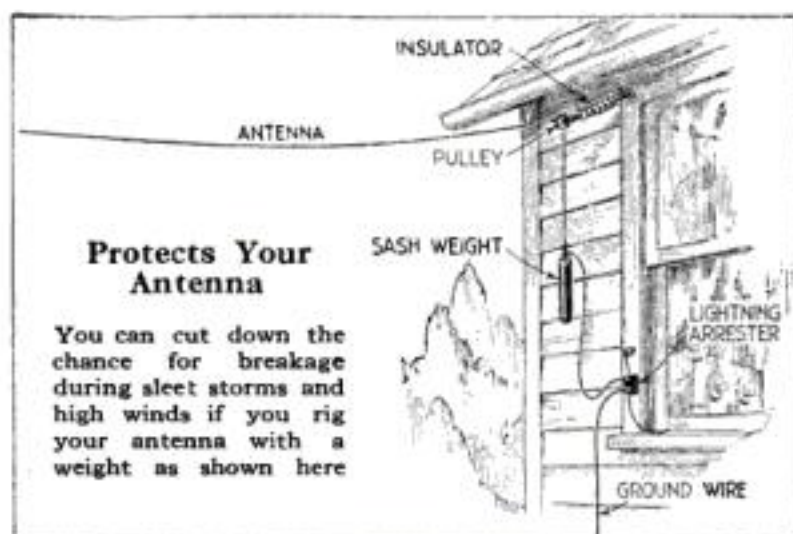
vices sold as a cure for fading, as such devices cannot improve conditions in the slightest.

Of course a more powerful set may help somewhat, because it will raise the whole level of signal strength so that the signal may be heard at its weakest instead of disappearing entirely.

### The Right C-Battery Voltage

**W**HILE the C-battery may, with some types of audio transformers, improve the quality of reproduction, the main advantage in its use lies in the fact that it adds to the life of the B-batteries by cutting down the amount of current drawn from them. In addition, the use of a C-battery will prolong the life of your vacuum tubes.

In most cases, of course, the best voltage for the C-battery is that recommended by the makers of the tubes used in the audio amplifier end of your radio set. Nevertheless, it is always well to experiment a bit, as tubes are not all alike and sometimes you may find that a slightly lower voltage will improve quality or that a slightly higher voltage can be used without impairing results. Always use the highest C-battery voltages possible without spoiling the music or speech, so as to prolong the life of your B-batteries and vacuum tubes.





*Here's a New Test of Your Auto Knowledge—Win a Cash Prize*

# What's Wrong with the Captain's Car?

*See If You Can Figure Out  
What Happened to His Motor*



**B**LAMED if the old craft ain't sprung a leak again!" muttered Captain Horne as a shrill hissing squeal indicated the sudden departure of the air from one of his rear tires. He jammed on the brakes and steered the car to the side of the road. "Reckon I'd better drop anchor here while I fix the dod-blasted 'boloney,'" he grumbled.

Captain Horne was no expert on autos, but thirty years spent in sailing the seven seas had instilled in him more than the usual share of resourcefulness and ingenuity. And the old sea-dog needed every bit of it to keep the car he was driving in running order.

He had been beguiled into buying a "reconditioned" machine, and the "reconditioning" had consisted mostly of a cheap paint job with little or nothing done to the badly worn mechanical parts.

"Holy mackerel!" he snorted as he found the blow-out. "The whole side of the tire is coming apart!"

The actual blow-out was only about the size of a pencil, but all around the hole the tire bulged ominously. It was quite evident that even a blow-out shoe would soon let go, and the old tar did not have one anyway. The spare tire had been used to replace a severe blow-out earlier in the day.

Captain Horne scratched his grizzled head reflectively. "I can fix the hole in the tube, but it'll only blow out again through the hole in the shoe—I've got to brace it somehow," he decided. "Let's see what's in the locker."

**H**E PRODDED around in the tool box for a few minutes, until his hand closed over a large roll of friction tape.

"I've got it," he said. "I'll just patch the hole and then sort of splice it by winding a couple of layers of tape right on the tube. Seems to me I ought to be able to pump the tube to about the size it is in the tire, and then if I wind the tape on carefully it ought to take most of the strain off the shoe."

The captain took care to see that the tube was inflated just

enough to fit the inside of the tire, and the job was successful.

"There," he exclaimed, as he finished pumping it up. "That ought to hold together till I can raise the price of a new shoe. Now let's see if the old boat won't sail along."

But the captain was doomed to disappointment. He had proceeded about five miles when the motor suddenly appeared to lose power. It seemed to be running smoothly, no cylinders appeared to have quit the job, and the captain could detect no unfamiliar noises.

"Must be running out of wind or something," he observed uneasily. "Guess I'd better make for shore and tie up at the next repair station."

It happened to be a rather uninhabited part of the country, and the captain passed one or two garages that catered only to the summer trade and were now closed tight. Every mile or two some-

## Did the Blow-Out Cause His Troubles?

A shrill hissing squeal from one of the rear tires was the first warning that something was wrong with the captain's car. He patched the hole with tape, but that was only the beginning of his troubles

thing seemed to happen inside the motor and it would lose more power, until finally he had to drop into first speed to climb a long but rather easy grade.

"If I don't make port soon I'll be becalmed here for the night," he gloomed, and his prediction seemed well-founded, for at the top of the hill the motor stopped firing completely. No garage was in sight, but the car had passed over the ridge and he let it coast down the other side. The grade was so slight that the car barely kept in motion. In fact, at one place that was nearly level the skipper had to get out and put his shoulder to his craft to push it over. But his hopes perked up at the bottom of the hill, where there appeared a brand-new garage with a young fellow standing in front of it garbed in new, clean overalls.

"Run out of gas, did you?" the young man greeted the captain as he ran out and helped push the car to the garage.

"I don't see how that could be," Horne answered. "I filled up the tank just a way back."

**W**ELL, anyway, you came to the right place," the young fellow assured him. "I can fix anything on wheels. Just you watch."

The captain lighted his pipe and prepared to learn something about auto repairing. The young fellow brought out a new and shiny kit of tools and lifted the hood in a very businesslike manner. He stepped on the self-starter and the motor turned over at normal speed; but it did not start. Then he tested the ignition system. It, too, appeared to be in running order.

"Here's your trouble," he announced finally, pointing to the carburetor filter screen he had

(Continued on page 129)



## Help Him Out and Win a Prize

**P**OPULAR SCIENCE MONTHLY will pay \$25 for the best letter explaining the trouble with Captain Horne's car and telling him how to overcome his difficulties. Was the fault in the ignition? The carburetor? The battery? The vacuum tank? Even the garage man was puzzled. Your letter will be judged solely on how accurately you size up the trouble and suggest the remedy. Letters must reach us before January 31, 1927. Address Automobile Editor, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York City.





### for attics

Use Upson Board to build in useful rooms; at the same time insulate against heat or cold.



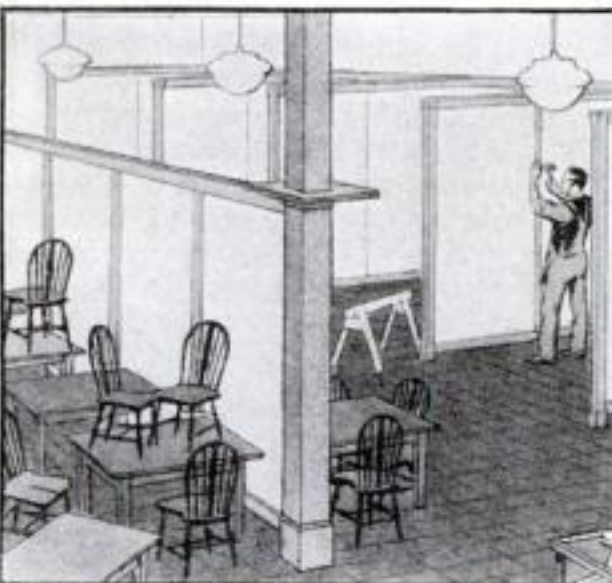
### for ceilings

One man can apply Upson Board right over cracked plaster with a permanently beautiful result.



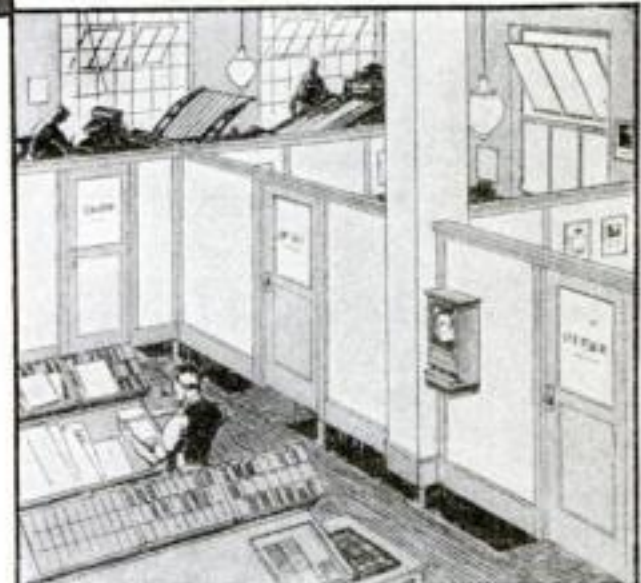
### for bath or kitchen

Upson Fibre-Tile will build snow-white, water-proofed wainscotings—at about 1/10 the cost.



### for business

Attractive booths, partitions, jar-proof ceilings, window displays, screens, built-in offices.



## As useful as a hammer or saw!

**T**RY Upson Board for re-covering just one cracked plaster ceiling—or for building in useful rooms in home or store!

Then you will know why this dependable building material is in use in over a million buildings—with less than one complaint to every eight million feet sold and used.

Upson Board comes in big, strong panels, yet so light one man can apply them even on ceilings.

Goes up in  $\frac{1}{3}$  the time of plaster—at a fraction of the cost.

Properly applied, dependable blue-center Upson Board can never warp or bulge or crack or fall. It resists heat, cold, jars, moisture, fire and is the one board that can be applied without ugly nail marks.

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# New Helpful Hints for Autoists

## Tire Inspection Made Easy—Sewing a Tube—Other Ideas

**I**NSPECTING the inside of an automobile tire for nails or breaks in the fabric is made easier by the simple, homemade device sketched in Fig. 4. Plenty of leverage is supplied for spreading the beads.

All you need to make the device is two boards of the dimensions given in the sketch, a hinge, two eyebolts and two strap iron hooks six inches long. The distance between the hinge and the eyebolt in the base should be about ten inches, and the eyebolt on the lever should be six inches from the hinge. Use standard strap iron for making the hooks.

### Stops Crank-Handle Rattling

**T**HE easiest way to hold the crank handle up out of the way of the license plate and to keep it from swinging back and forth continually and thus causing excessive wear on the bearing, is to cut off a piece about  $1\frac{1}{4}$  inches wide from a piece of old inner tube either 29 by 4.40 or 32 by 4 size. After the lamp plug is removed from one of the headlights, the piece of inner tube should be slipped over the headlight and snapped around the crank handle as shown in Fig. 2. The quality of the rubber in auto inner tubes is so good that the band will last for a long time.

### Sewing Up a Blow-Out

**M**ANY motorists are under the impression that a tube is beyond repair if it blows out in a long rip. However, it is possible to save such a tube by sewing up the rip carefully with a needle and silk thread, using an overstitch that will bring the edges of the rent together smoothly. A patch can be applied with rubber cement in the usual way, and it is also possible to vulcanize the tube with a five minute vulcanizer by using the oblong patches and overlapping them until the rip is completely covered. Fig. 7 shows how to sew up the tube and apply the patch.

### Luggage Stored on Top

**A**S SHOWN in Fig. 3, the top of an inclosed auto body can be used as a fine luggage compartment that will hold extra



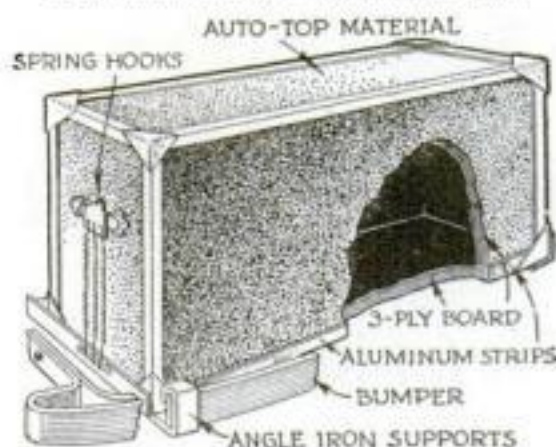
Fig. 6. If your fan pulley slips, hold it with special set screw

coats, blankets or parcels and preserve them from dirt and rain. It is particularly useful for motor campers and long distance tourists.

The construction is very simple.



Plywood and aluminum make this lunch kit light and strong. Fig. 1 (below) shows how it is fastened in place



### Plywood Lunch Kit Easily Made

**A** SUBSTANTIAL container for picnic lunches or campers' equipment can be made of three-ply wood, glued and nailed and covered with auto top material to render it waterproof. As shown in Fig. 1, it is bound with aluminum binding strips and aluminum corners so that the construction is light and strong. Snaps, handles, loops and springs are of the ten cent store variety. A feature of the container is the springs that hold the case on the special rack built up of angle iron and supported by the rear bumper. No straps are needed and the case can be removed in a second's time.



Fig. 2. How the crank handle can be held up out of the way so it will not rattle or hide the license



Fig. 3. The top deck of a closed car converted into a fine luggage compartment by fitting with a loose cover provided with snaps

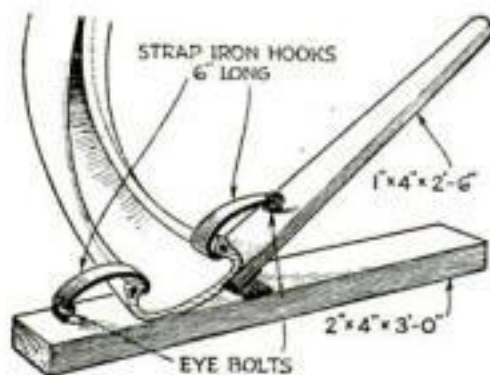


Fig. 4. Plenty of leverage enables you to inspect every part of the inside of an automobile tire with this simple device



Fig. 5. An old inner tube will disguise your new spare tire so it will look old

### Old Tube Fools Thieves

**A**N OLD inner tube that you may have on hand will make a good cover for the spare tire (Fig. 5). At a distance of a few feet it gives the appearance of an old tire that is worn smooth or has been retreaded, and thieves are likely to pass it by. Cut the stem out of the old tube and slit it all the way around. The tension in stretching it into place over the shoe will make it fit snugly without wrinkles.

### If Your Fan Pulley Slips

**I**F YOU are bothered with a fan pulley that keeps working loose, here is a way to remedy the trouble. Cut away part of the web as shown in Fig. 6 and drill and tap the hub for a hardened set screw. The pulley

will stay in place. It is a good idea to spot the shaft with a drill through the set screw hole when the pulley is in the proper position to insure rigid clamping.



Fig. 7. Careful sewing will often save a blown-out auto tube



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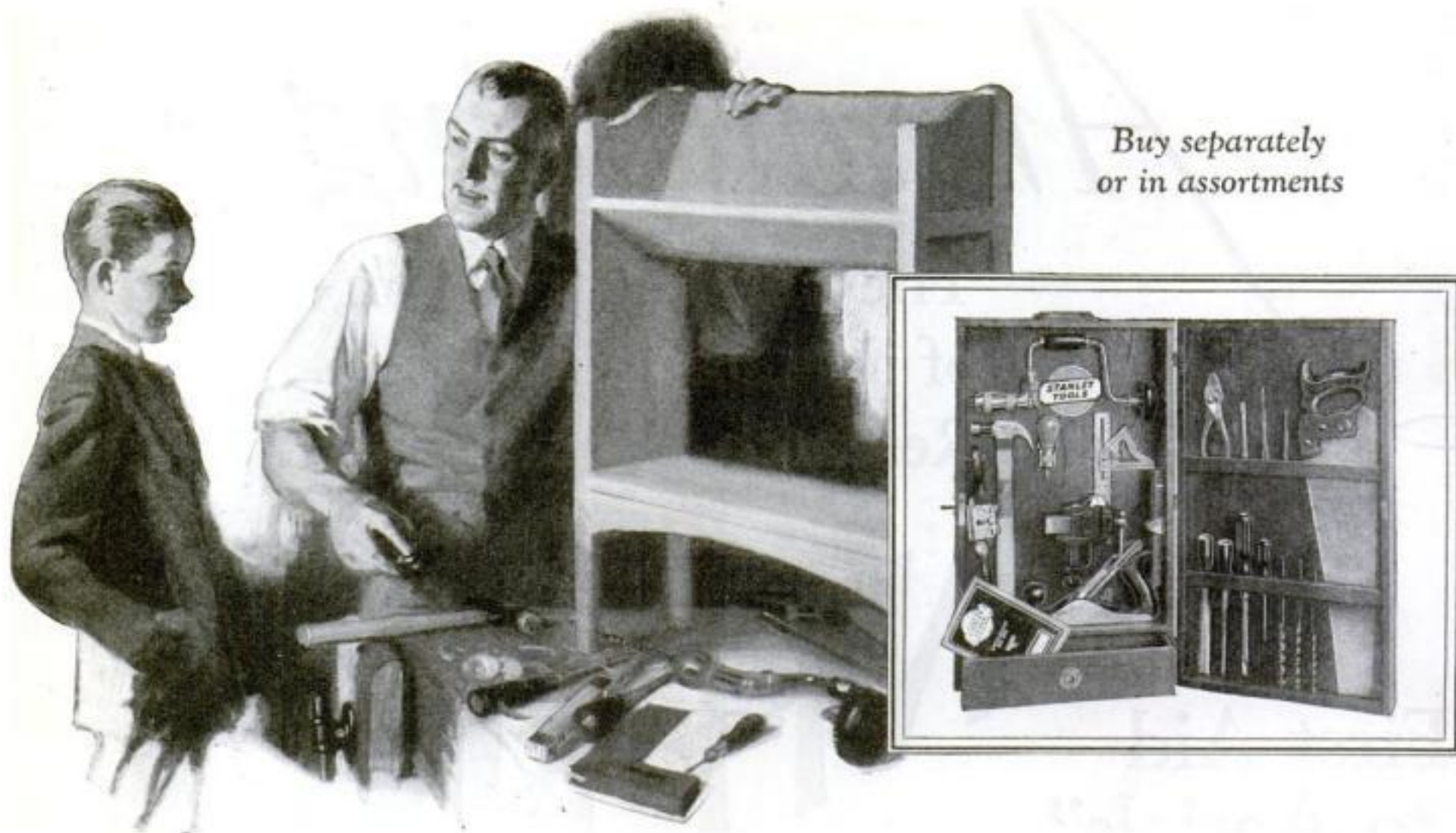
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# STANLEY TOOLS





# The Home Workshop

Arthur Wakeling, Editor

## "Old Ironsides" in Miniature

### How to Build a Simplified Model of the Frigate CONSTITUTION

By CAPT. E. ARMITAGE McCANN

WHO is there with a liking for things of the sea and a desire for beautiful decorations in his home who would not take delight in owning a model of "Old Ironsides," the most famous ship that ever carried the Stars and Stripes?

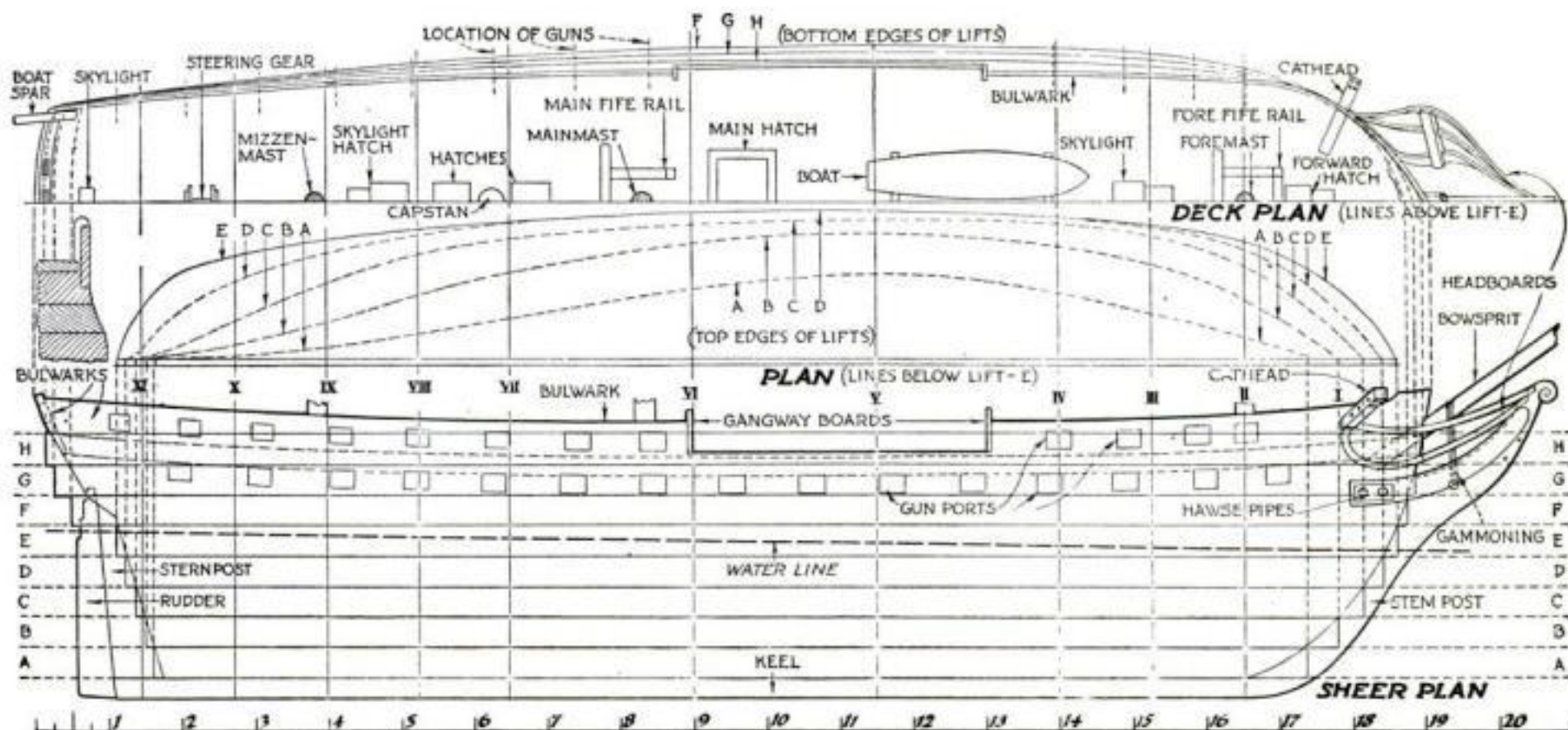
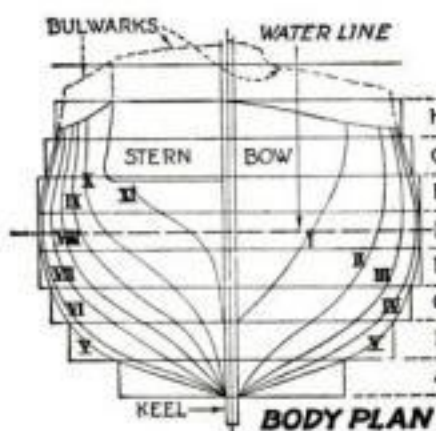
In her is embodied the spirit of the American Navy. Every school child learns her history and knows the story of her valiant battles. She not only played a monumental part in the early wars of the Republic, but she has figured gloriously in fiction, poetry and the movies. Just now she is the center of intense national interest because of the campaign conducted for funds for her restoration, which is to begin in the spring of 1927 at the Boston (Charlestown) Navy Yard.

As the history of the *Constitution* is to be found in many books and numberless articles, it will be sufficient here to say that her keel was laid down by Joshua Humphreys, of Philadelphia. She was built after the "best French practice" on the lines of a battleship, but with one deck less, making her a frigate. She was commissioned in 1798, one of the first three up-to-date warships to be built for the young Republic. She saw service in the French War, dictated peace to four of the Barbary Corsair States, and won a succession of victories in the War of 1812.

She was in active commission for eighty-four years. In (Continued on page 88)



Captain McCann making the final adjustments to the rigging of his model of the *Constitution*. This represents the famous frigate substantially as she appeared during the War of 1812



The lines of the hull, which is built up in a series of eight "lifts" on the "bread-and-butter" plan. These drawings and all other details, including

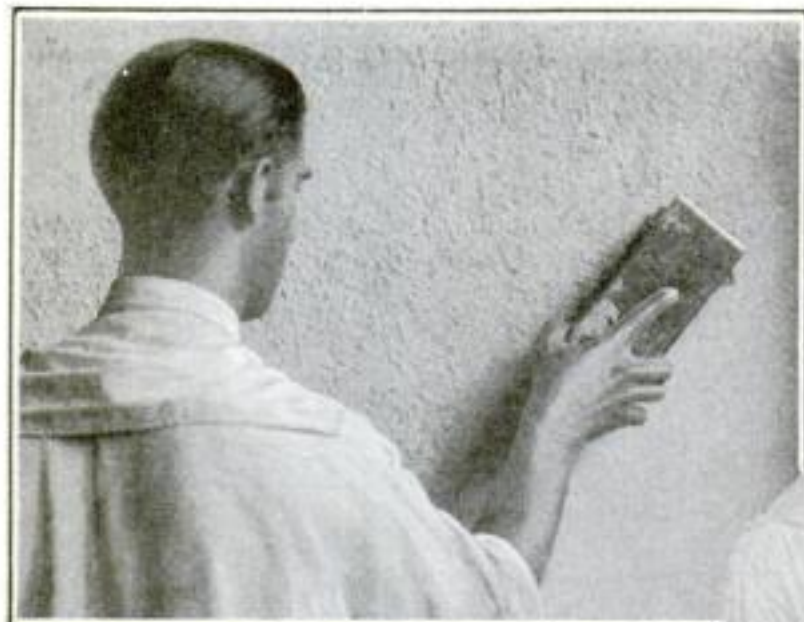
the rigging, appear full size on POPULAR SCIENCE Blueprints Nos. 57, 58 and 59, which can be obtained for 75 cents (see the coupon on page 85)



# Decorating with *Plastic Paint*

*Easy Ways for You to Do Over Old Walls and Ceilings—How to Apply Finishes in Spanish, Monastic, Italian and Colonial Styles*

By  
E. M.  
OREN



Developing a Colonial stipple finish. The brush is known as a painter's "stippling block"



The Spanish texture is obtained by stroking the wet paint with the bowl of a common kitchen spoon

**I**T WAS Eleanor's notion that we do the living room over in a rough-textured finish. And the notion had deep roots and wouldn't be denied. She hadn't been back from California for twenty-four hours before she started to talk about the "jazz plastering" effects that she had seen there.

"They are so lovely!" she exclaimed. "Walls of almost every color, and rough-texture effects beyond the possibility of counting." After a moment of silence, she went on: "Now, take that living room of ours—"

And I knew I was in for it. There could be no pleading that I didn't know how. Eleanor assured me that "Everyone says that rough-textured walls are simple to produce." She clinched it by discovering that the only house in our town that could possibly qualify as a mansion had rough-textured walls in almost every room; even the kitchen was finished in a refined stipple.

The things I discovered about color and texture possibilities through the use of plastic paint—which is to be distinguished from other paints—were a revelation. Before I was through I was developing original textures. I was doing sunburst and swirl effects and even imitating travertine marble. Instead of doing just the living room over, I went ahead and redecorated all six rooms in our house and the hallway as well. Our neighbors and guests will testify as to the effectiveness of the result.

**B**UT to begin at the beginning: I went, of course, to a paint store. Could they help me? Most certainly. And the owner told me about plastic paint.

"It comes," he said, "in the form of a white powder and all that is added to it is water and color. It is applied with a large brush and while it is 'tacky' the texture is developed."

Long experience has taught me the wisdom of "be sure you're right, then go



Before being added to the plastic paint, the tinting color is mixed into a paste with water

ahead," so I purchased only a ten-pound package of plastic paint and went home to do a test job on a piece of wallboard I had in the basement. The paint dealer had given me a booklet, furnished by the manufacturer of the plastic paint.

**I**N PERFORMING the test I followed directions. First, I cleaned the surface thoroughly. Then I applied a coat of size. The size came in powdered form in the package with the plastic paint. As the size should be allowed to dry for six hours, I let four hours elapse before starting to mix the plastic paint. Later, when doing an entire room, twelve-quart pails were used for mixing, but for the test job I used a kitchen mixing bowl. The proportions of the mix were one pint of water to one pound of plastic paint. This gave a consistency of heavy cream.

Next I mixed the tint in a separate pan. We had decided on a buff color and a rough texture adapted from the Spanish. Dry yellow ochre was mixed with water to the consistency of a paste. Then the color was added to the plastic paint and the whole was stirred until the color was evenly distributed. The plastic paint comes out a very little lighter on the walls than in the paint and this must be allowed for.

For application I used a Dutch calimine brush and laid the material on from  $\frac{1}{8}$  to  $\frac{1}{4}$  in. thick. When it had "set up" slightly, I began the development of the Spanish texture. The tool

used was an ordinary kitchen spoon and all that was required was to move the back of the spoon across the paint in short, partially curved strokes.

The test panel was a success. Eleanor had watched all its developments and when it was finished let out an excited "hurrah!" It was only necessary to repeat the performance on the walls and the one extra precaution to be observed was that of mixing enough material to cover the entire wall area so as to eliminate any possibility of different shades of color. As we were decorating over a painted wall it was not necessary to apply a coat of size, but where the paint was scaling or loose it was scraped off. Fortunately there were no cracks. There were, however, some small crevices, and these were filled with a thick mixture of the plastic paint and then sandpapered.

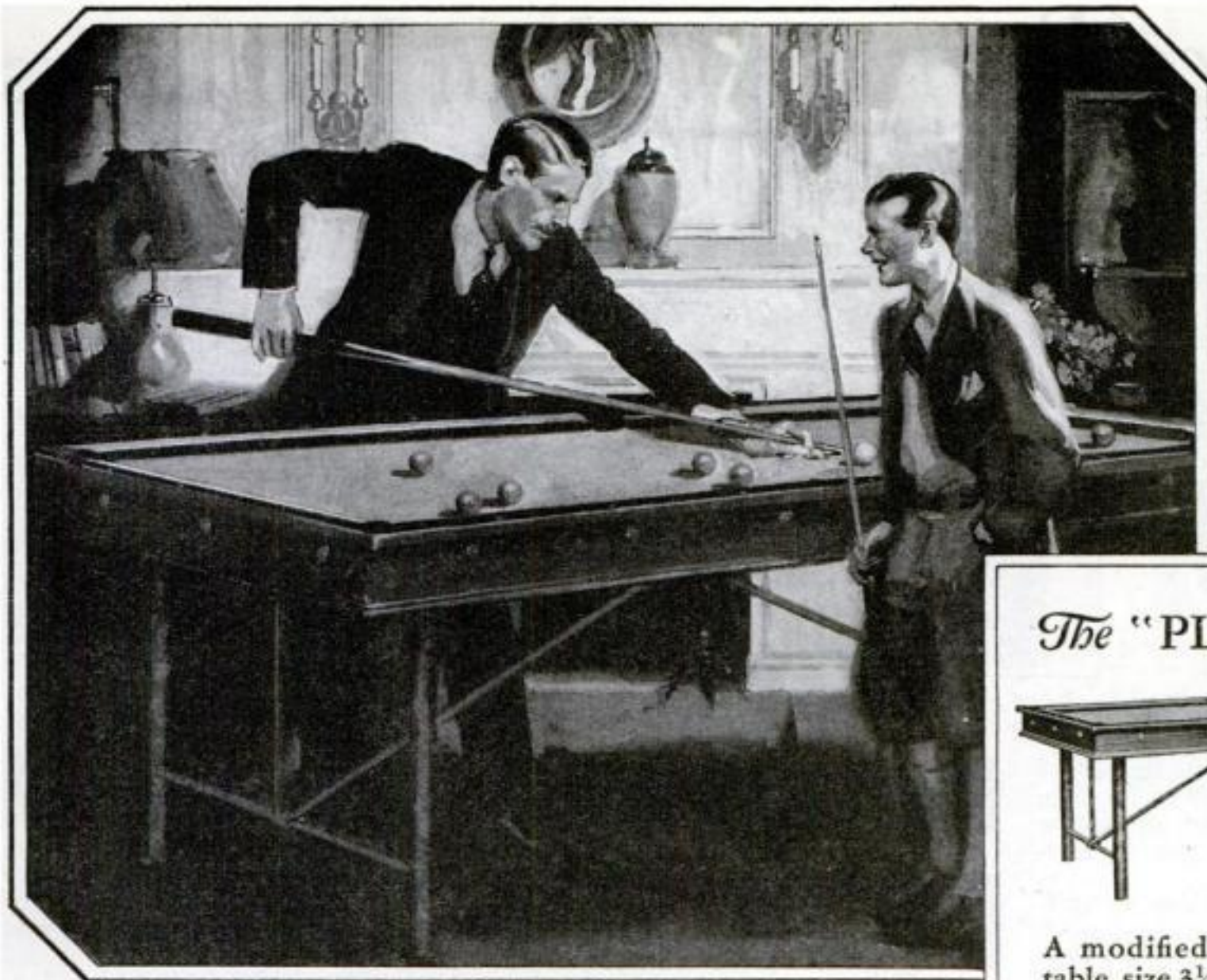
Eleanor was pressed into service when it came to applying the plastic paint. It is doubtful if she could have been kept from helping, she was *that* interested. Alternately she took her turn with the brush or the spoon. In a few minutes over six hours the job was completed.

**F**OR the ceiling we had decided on a monastic texture, found in many old monasteries. Cream was the color chosen and yellow ochre again was used, only this time less of it. Again a test panel was made so that we could be sure of our ability to reproduce the texture before starting on the ceiling. Incidentally, this method of practicing on a panel is the way of "making sure you're right before going ahead," when it comes to plastic paint.

For reproducing the monastic texture, a 4-in. wall brush was worked in short, semicircular sweeps so that one brush-sweep crossed another or started out from it. Actually, the brushing could be called "at random"; the entire surface virtually was

(Continued on page 84)





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This remarkable Brunswick table, the "Playmate", isn't a toy. It's a modified, standard, slate bed billiard table. Read the description at the right. Then fill out and mail the attached coupon for full details, prices, etc. Do it today.

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# Valance Boards for Your Windows

## How to Cut and Decorate Them—Colonial and Modern Designs—Color Schemes

By MARIE CHILDS TODD



A graceful painted board, in the early American character



A long valance board made by one of Miss Todd's high school pupils. It is finished in Chinese red with a dragon in green gold



Curved corners are the distinguishing feature of this design

**V**ALANCE boards across the tops of the windows often will give a room just that touch of distinction necessary to raise it above the commonplace.

The advantage of a wooden or wall-board valance is that it is easily cleaned, the colors may be retouched, and it outwears a textile valance. It also conceals unsightly curtain rods.

The accompanying sketches will suggest ways of varying the designs of any valances you make so that they will express your own taste in line, mass, and color, and give the individuality that is of paramount importance in all matters of home decoration.

These valances are just as effective in houses and apartments in our country today as they were in the Colonial mansions of the early Eighteenth Century. One of the most charming customs was the use of painted valances for windows and for four-poster beds.

A bedroom that I saw in an exhibition of original Eighteenth Century furnishings had very graceful, colorful wooden valances for the windows and also a four-poster bed valance to match. The color scheme was rose and gray-blue and yellow on an old ivory background tone. Music was the motif, or idea, for the center design of the window valances—an oblong medallion formed of a group of three musical instruments combined with an open book of music. The end boards of the valances, which were fastened against the wall at either side of the windows, were made with graceful curved surfaces. The window and four-poster bed draperies were of block-printed muslin in a light and dark crimson on an ivory white background similar to the very popular *toile de Jouey* hand-printed cloth.

**T**HE valance boards give the crowning touch of elegance to our modern rooms and heighten the charm and color of window draperies, whether used in living rooms, bedrooms, dining rooms, or breakfast rooms.

A wooden valance does not need to be exactly the color of the woodwork of a room, but its background tone should



Flower basket design, ship motif in raised gesso work, and a textile covered valance

harmonize either with the drapery color scheme or with the walls.

First find the exact over-all width of your windows. To this add  $1\frac{1}{2}$  in. to allow  $\frac{3}{4}$  in. on each end for the bracket or end pieces, which are screwed against the outside of the casing. (See the illustration on page 78.) These valances are usually about 9 in. deep. When more than one valance board from the same pattern is required, always start with the broadest window and diminish the pattern for the smaller windows.

Woods that are good for these valances

are white pine, gum, yellow poplar, maple and birch. Thoroughly seasoned and kiln dried stock should be obtained from a lumber company or your carpenter or cabinetmaker. White pine is especially good for staining in an antique tone and waxing; it is a wood much associated with Colonial interiors.

Fiber wallboard is readily adaptable to the making of window valances or cornices and has the advantage of being light and very easy to cut. The edges must be sandpapered and treated with shellac to insure a neat appearance when finished.

Cut one board first to be sure you are working correctly. If you care to pay a local carpenter or a lumber mill to cut your first valance boards, it will seem a very simple matter. Have your design clearly drawn in outline on a large sheet of wrapping paper.

The tools necessary, if you do your own work and use wood, are a keyhole or compass saw (or a turning saw), an ordinary hand saw, a small plane a rasp or wood file and plenty of sandpaper.

A spokeshave also is an aid for smoothing curves, and often several large sized auger bits or an expansive bit can be used to advantage.

Cut your board first in a rectangular shape the length and depth desired. It is a good plan to allow about  $\frac{1}{8}$  in. extra all around for planing and sandpapering.

**F**IND the center of your board and place the pattern on the center line. Working toward the right-hand end, thumb-tack your pattern to the board and trace it carefully. Then remove your pattern, reverse it and mark the other half of the board.

In sawing keep about  $\frac{1}{8}$  in. outside the outline. Use a wood file or spokeshave to remove the rough edges and finish with sandpaper.

Two end pieces are required for each valance board; these usually are 4 in. in depth. These are [\(Continued on page 78\)](#)



Both valance and draperies in this charming room match in their background color

Turn to page 74 for the continuation of the Home Workshop Department.



## Good Pay, but - They are Not Getting Ahead

Their Problem  
solved by this  
Rational Worryless  
New Life

### Human Independence as worked out by a 63-year old Organization

**H**OW blindly do some people go along barely fighting off expenses! And yet how narrowly they miss a competence, miss independence. Capable and industrious, they occupy positions for which they are not suited and struggle against conditions which weigh them down.

Such a practical organization as the Brotherhood of Locomotive Engineers, whose financial operations extend from coast to coast, has for more than sixty years made a study of living and working conditions with a view to solving the problems of just such people as these.

If your earnings, though good, fail to yield a real margin above expenses, you can well investigate what the Brotherhood is doing on its farms at Venice on the Gulf, to provide a substantial basis of financial independence for families or a newer, freer life, in Florida's health-giving air and sunshine.

Venice Farms, in tracts from five acres up, offer a great variety of speed-profit crops, three or four a year if you like—which reach markets ten to sixty days earlier than other sections, and thus command highest prices.

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Venice life is divided between agriculture, industry and resort activities. Vacationists remark the variety of diversions. Here one finds the West Coast's only mainland beach and its most famous fishing grounds. Here is a modern city planned and built by experts, which fronts on the beach. Adjacent to it is the largest and most comprehensive farm development ever projected in America.

Venice hotels, with fixed rates at \$5 to \$15, and plenty of rooms at \$5, serve fruit, vegetables, milk and cream received fresh each day from Venice Farms nearby. Conveniently located are well kept golf courses, tennis courts, quoits and other games, and excellent hunting and fishing are found on the tropical Myakka River.

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# Better Shop Methods

*How Expert Mechanics Save Time and Labor*



## Secrets of Successful Boring

*How to Sharpen Tools for Use on Scale-Coated Cast Iron and Bronze—  
Roughing and Finishing—The Best Shape for Cutting Steel and Aluminum*

"WHAT I'd like to know is whether there is any kind of a tool that will stand up long enough to bore these bushings!" Harvey exclaimed in disgust as he removed a boring tool from the lathe tool post and walked over to the grinder.

Eight bronze bushings like A in Fig. 1 were to be bored and reamed and Harvey was using an ordinary forged boring tool, B.

Mr. Grimes, the efficiency engineer, happened along just as Harvey was resetting the tool and inquired how things were going.

"All right except that I'm having some trouble keeping this tool sharp," the young machinist responded. "This bronze scale is fierce! It takes the edge right off the tools."

"Bronze scale is always bad, Harvey, but it seems to me that I wouldn't do the job just that way if I were doing it."

"Why, what's wrong?"

"Nothing really bad, but I believe your method could be improved. In the first place I wouldn't grind the tool as you have it (A in Fig. 2). I'd give it this shape."

The engineer sketched the tool B (Fig. 2) on his always handy memo pad.

"But I always thought a round-nose tool was better for boring," objected Harvey.

"That isn't always true. It depends upon conditions. Have you stopped to think what causes your round-nose tool to get dull so quickly?"

"It's the scale, isn't it?"

"UNDOUBTEDLY. But you can easily see that a round-nose tool will tend to ride up on the scale while one ground as at B gets under it. Let's grind another tool giving it about five degrees back angle and see what happens."

Harvey ground a tool as directed and put it back in the holder again.

"Now, don't use too much feed," cautioned Grimes; "not over five thousandths per revolution."

Much to Harvey's surprise, the tool bored completely through the piece without growing dull. It appeared keen enough for the finishing cut, so he started the cut and, turning to Grimes, remarked: "That scheme works fine, but it doesn't give as smooth a hole as

By ALBERT A. DOWD

*Consulting Engineer*

the round-nose tool. That isn't so good."

"That's true," admitted the engineer, "but the reamer will give you just as good a hole as before, and that's what you are looking for."

"Let me ask you something else, Mr. Grimes. Should a boring tool be set on

ute," the older man said. "If the tool is set on center as at A, the tool springs downward under a heavy cut and digs into the work. If the tool is below center, the same thing happens and the tool digs in still more. Now look at this sketch (B), in which the tool is set above center. When the tool springs downward, it is thrown away from the work, so it doesn't chatter."

"Then some of the other fellows in the shop are dead wrong, Mr. Grimes. I see the principle of it now; of course the tool should be above center."

"The important things in boring, Harvey, are the shape of the tool and its position. For work that has been drilled first, the shape of the tool is not so important, but for working in any kind of a cored hole, the tool should be carefully shaped so it will not ride upon the scale."

"What about flat cutters for boring? Do they give as good results as single point tools?"

"That depends on the work," Grimes answered. "Here is a flat cutter bar (A, Fig. 4), both ends cutting at B and C. This kind of a bar is very good when concentricity is not of importance, but it is not strictly a generating tool as it has two cutting points opposite each other. In reality the cutting action is more nearly like a drill—not to be depended on for a cored hole. This type sometimes can be used to advantage for rough boring, but it should always be followed by a single point boring tool in order to generate a true hole."

HARVEY next suggested that what he should like to know most of all was what kind of boring tools to use for cast iron, bronze, steel, alloys and aluminum and what is the difference between them in respect to cutting action.

"If you'll tell me those things, I'll be happy," he added hopefully. Grimes laughed.

"You don't want much, do you? I will give you a few interesting points to watch out for anyway, even if I" (Continued on page 108)



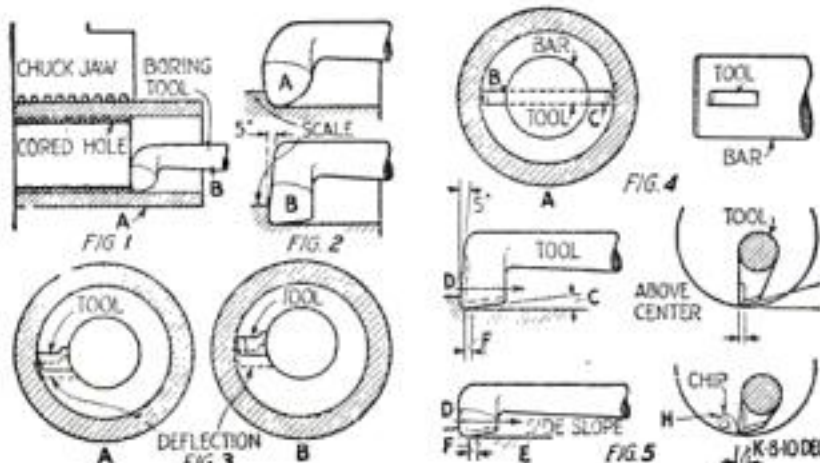
"I'm having some trouble keeping this boring tool sharp," said Harvey. "The bronze scale is fierce!"

center or not? Some of the men say it cuts better a little below."

"You come up to the house tonight and I'll tell you and give you a few other pointers about boring tools. We can't talk about it while you are busy on that job—you've got your hands full."

So that evening Harvey appeared with his note book, now pretty well filled with notes on machine shop practice. He reminded Mr. Grimes of his question about the position of a boring tool.

"Look at this diagram (Fig. 3) a min-



The principles involved in grinding boring tools and setting them in relation to the center of the work

MANY time-saving shop ideas are contained in the continuation of the Better Shop Methods Department, on pages 104 to 110.





**here's the  
trick for  
close quarters—**

The No. 151 Starrett Hacksaw Frame. Take a good look at it—and then think of all the tight corners you've tried to use a hacksaw in. For repair jobs on the car—getting at fender and body bolts, Ford bands, etc.—around the radio set, odd jobs of pruning and—well, there's a whole flock of odd jobs of cutting around the average home for which this frame is just the trick.

Ask your hardware dealer to show you the No. 151. And write us for descriptive matter and a free copy of Catalog No. 23 "W."

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Steel Tapes—Standard for Accuracy  
ATHOL, MASS.*



368

# Use Starrett Tools



# The Home Workshop

## Easy Ways to Build Four Styles of Decorative Hanging Bookracks

By HERMAN HJORTH

**H**ANGING bookracks are enjoying a renaissance of popularity. Interior decorators and those who set the fashions in furniture have given their approval to these decorative and most useful pieces.

Sets of books, novels, magazines and other forms of printed matter accumulate with such amazing rapidity that the family bookcase is overflowing and the good housewife distracted with the problem of how to take care of the surplus and still keep the home looking tidy, especially when space and cupboard room are at a premium.

The four bookracks illustrated herewith should, therefore, be welcome additions to the furnishings of almost any household, because they provide more book space in the home without encroaching upon the space needed for other pieces of furniture. They are designed to hang over a desk, on a pillar between two windows, in a cozy corner, or on any convenient wall space. They are simple of construction and inexpensive.

Before actually beginning the construction of any one of them, however, the author earnestly recommends each interested reader to measure the wall space available for such a

bookrack, as well as the books to be placed on its shelves. Books vary so much in size that it is quite possible that the designs submitted may have to be changed a little to meet individual needs.

The bookrack illustrated in Fig. 1 is the simplest in construction; it consists only of two sides and three shelves. First

plane these five pieces of lumber to the finished dimensions given in the stock bill on page 76. Lay out the dados very carefully on both the side pieces, clamp them to the bench, and cut the outline by using a sharp 1-in. chisel and striking it lightly with a mallet (Fig. 1, A). Cut a groove as shown at B and saw down to the gage line with a backsaw (C). Re-

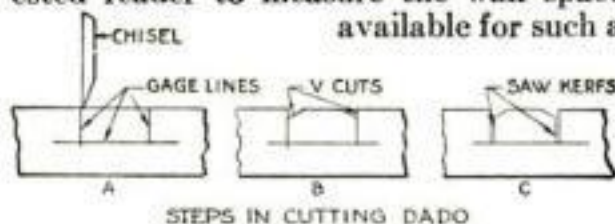
move the waste wood with a router plane or a 1/2-in. chisel. Cut the other dados in the same way and give them all a light, final cut without changing the setting of the router plane, so that they will all be of the same depth.

This work must be done very accurately so that the shelves will fit tightly. Note that the dados are not cut all the way across the sides, but stop about 3/4 in. from the front edge. See the isometric sketches in Figs. 1 and 4 and the notches at the front

(Continued on page 76)



Hanging bookracks like this are charming pieces when well designed and constructed



STEPS IN CUTTING DADO

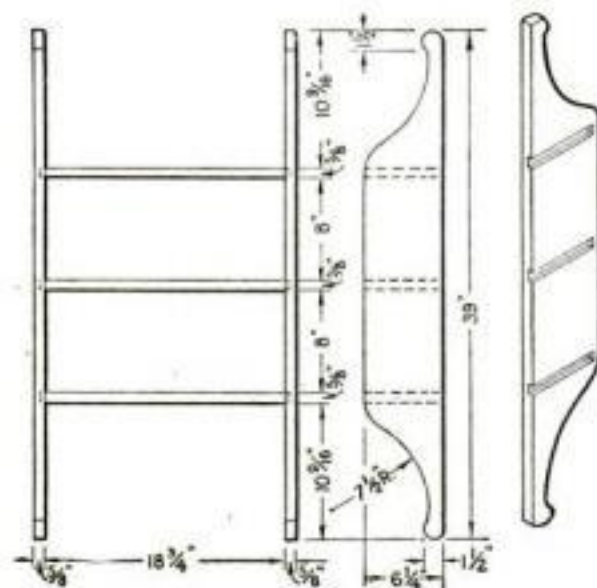


Fig. 1. The simplest type of hanging bookshelves. Only five pieces are required



DETAIL OF DOORS AT CENTER

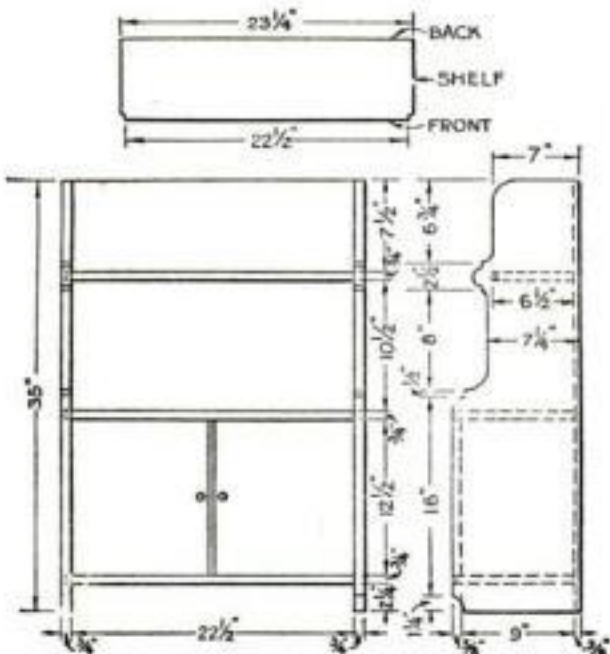


Fig. 2. In this cabinet doors conceal a compartment for magazines and odd papers



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HAMMER  
No. 11 1/2

**E**VERYWHERE about the home—from cellar to attic, from kitchen to garage—you will find need of a good Hammer.

There is a style Hammer in the extensive Pexto line to meet your requirements—ask your dealer to show them to you—thirty styles in all and all practical sizes of each style. They are drop forged steel, carefully finished and properly hardened.

All Pexto Tools are backed by a century of tool making experience. The line consists of Bit Braces, Hammers, Chisels, Screw Drivers, Hatchets, Snips, Squares, Wrenches, Pliers, and many other small tools and it is easy to procure Pexto Tools as they are carried by practically all progressive dealers.

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**PEXTO**

Worth While  
**TOOLS**



**30  
DAYS  
FREE  
TRIAL**

# 7 Tube Set Single Dial Radio



*The*  
**Metrodyne**

**ONLY ONE DIAL TO TUNE**

## Wonderful Offer Direct from the Factory!

A perfect working, single dial control, 7 tube receiver. And just to prove our claims, we will ship it to your home for **30 days' free trial**. Test it under all conditions. Test it for distance, volume and tonal quality—and if you are not convinced that it is the best single dial set you ever heard, return it to the factory. We don't want your money unless you are completely satisfied.

**Retail Price**

**\$75**

**Completely Assembled**

**Big Discounts  
to Agents and Dealers**

### BIG PROFITS TO AGENTS AND DEALERS

Our Agents and Dealers make big money selling Metrodyne Sets. You can work all or part time. Demonstrate the superiority of Metrodynes right in your home. Metrodyne Radios have no competition. Lowest wholesale prices. Demonstrating set on 30 days' free trial. Greatest money-making opportunity. Send coupon below—or a letter—for our agent's proposition.

## Metrodyne Super-Seven Radio

A single dial control, 7 tube, tuned radio frequency set. Approved by America's leading radio engineers. Designed and built by radio experts. Only the highest quality low loss parts are used. Magnificent, two-tone walnut cabinet. Artistically gilded genuine Bakelite panel, nicked piano hinge and cover support. All exposed metal parts are beautifully finished in 24-k gold.

An easy set to operate. Only one small knob tunes in all stations. The dial is electrically lighted so that you can log stations in the dark. The volume control regulates the reception from a faint whisper to thunderous volume, 1,000 to 3,000 miles on loud speaker! The Metrodyne Super-Seven is a beautiful and efficient receiver, and we are so sure that you will be delighted with it, that we make this liberal **30 days' free trial offer**. You to be the judge.

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**Let us send you proof of  
Metrodyne quality**

F. L. Warnock, Greentown, Ind., writes: "I received the Metrodyne in good shape and am more than pleased with it. Got stations 2,000 miles away."

C. J. Walker, Mariposa, Calif., writes: "Received my Metrodyne Single Dial set O. K. I believe that these one-dial sets are going to be excellent sellers. I had no trouble in tuning in stations enough to satisfy anyone, so you will please send me another set."

Roy Bloch, San Francisco, Calif., writes: "Very often we travel from New York to the Hawaiian Islands quickly—from station to station—by means of the little tuning-knob which operates the electrically-lighted dial. The Metrodyne Single Dial Set is much easier to operate than any radio set I've ever seen."

We will send you hundreds of similar letters from owners who acclaim the Metrodyne as the greatest radio set in the world. A postal, letter or the coupon brings complete information, testimonials, wholesale prices, and our liberal **30 days' free trial offer**.

**METRO ELECTRIC COMPANY**  
2161-71 N. California Ave., Dept. 151  
Chicago, Illinois

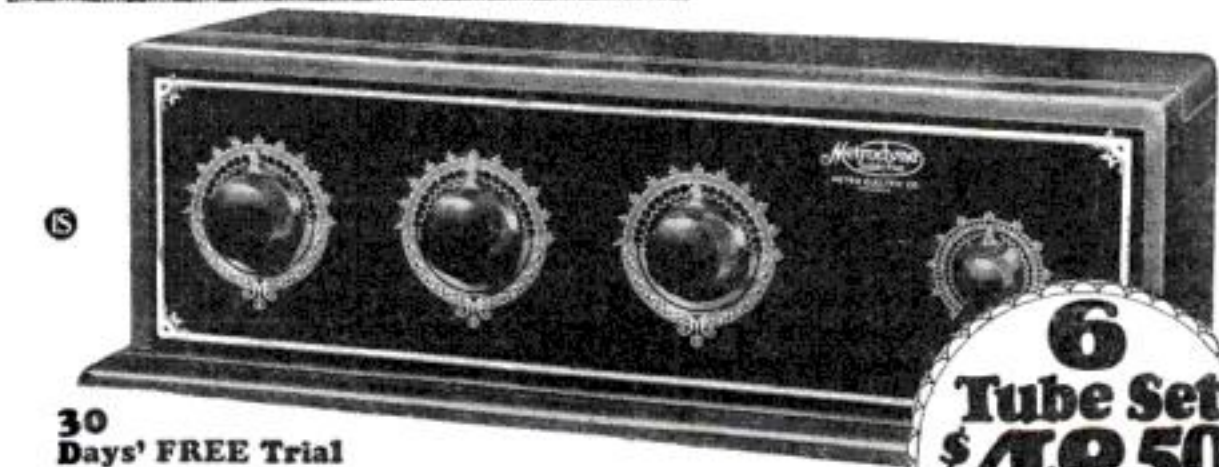
Gentlemen:

Send me full particulars about Metrodyne 6 tube and 7 tube sets and your **30 days' free trial offer**

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If you are interested in AGENT'S proposition, place an "X" in the square ☐



**30  
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Another triumph in radio. Here's the new 1927 model Metrodyne 6 tube long distance tuned radio frequency receiving set. Approved by leading radio engineers of America. Highest grade low loss parts, completely assembled in a beautiful walnut cabinet. Easy to operate. Dials easily logged. Tune in your favorite station instantly on same dial readings every time. No guessing.

Mr. Howard, of Chicago, said: "While five Chicago broadcasting stations were on the air I tuned in seventeen out-of-town stations, including New York and San Francisco, on my loud speaker horn, very loud and clear, as though they were all in Chicago."

We are one of the pioneers of radio. The success of Metrodyne sets is due to our liberal **30 days' free trial offer**, which gives you the opportunity of trying before buying.

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**6  
Tube Set  
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# "Voices That Are Human"



THE Aero B Amplipower can actually turn your radio set into a true musical instrument. When used with a good loud speaker it will reproduce every shading of tone, both vocal and instrumental. Low D on the bass viol booms out just like the original and high C is actually high C. With an Amplipower—voices are really human—not merely boxed-up reproductions.

The Aero B Amplipower not only makes possible the maximum in tonal quality and volume, but also supplies all of the "B" current for the radio set. Simply attach it to any set the same as a "B" battery, remove the last audio tube of the set and insert the Amplipower adapter and the Amplipower is ready for service.



The Amplipower will give you music that you never before heard on your radio—music that is music, with every note as rich and full as the original. Price \$65.00 without tubes. If your dealer hasn't Amplipower or Aero B, write us, giving his name.



Aero B is also built as a "B" power unit without the high voltage power tube—price \$50.00 complete.

THE GLENN L. MARTIN COMPANY  
Radio Division • Cleveland, Ohio

**AERO B**  
Amplipower and "B" Power Units

## The Home Workshop

# Decorative Hanging Bookracks

(Continued from page 74)

corners of the shelves in Fig. 2. This type of joint is called a "gain" joint.

The curves are now laid out on the outside of one of the sides according to the drawing and the two sides nailed together and cut at the same time. The nails, of course, should be driven in the part to be cut away so as not to mar the finished surfaces. If a band saw is not available,

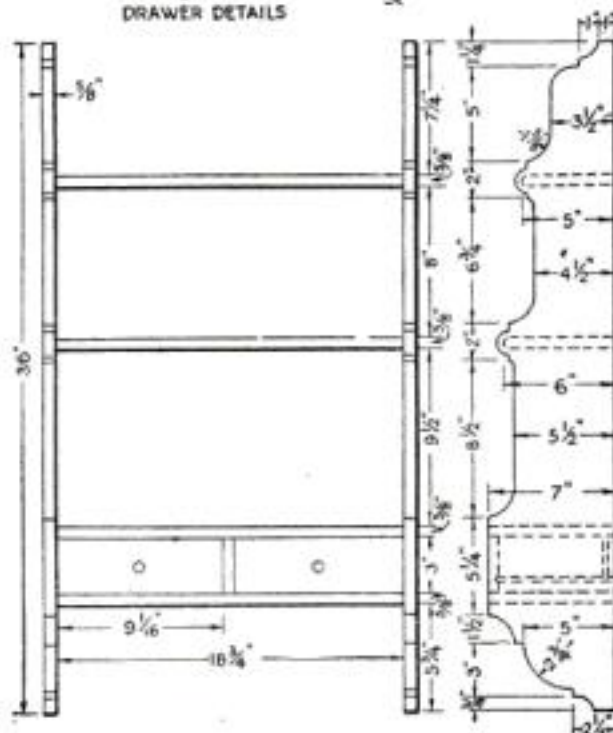
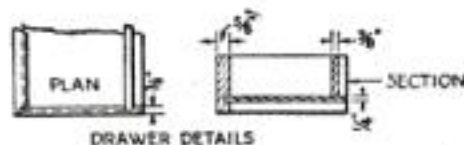


Fig. 3. A more ornamental type with small drawers fitted between the lower two shelves

the curves can be cut with a turning saw or a coping saw. Clamp the two pieces together and finish the curves with spokeshave, chisel, scraper, file, and sandpaper, being careful not to round the edges with the sandpaper. The shelves and sides are given a final scraping and sandpapering and the rack is then ready for gluing.

This must be done, for best results, in a warm room and both the glue and the wood must be warm. Use two clamps to each shelf and put blocks between the clamps and the finished surfaces so as not to mar them. Test for squareness with a try-square and wash off any surplus glue with hot water immediately after gluing and clamping. Leave the clamps on overnight. If no clamps are available it is easy to make some from waste lumber as shown in Fig. 5.

The bookrack, Fig. 2, is made in the same manner. After it is glued, doors are fitted in between the lower two shelves, so that magazines, papers, or other unsightly written matter may be kept there. Three ways of finishing the doors are shown. The first (A) is rather difficult to do without machinery. The second (B) shows a piece of wood glued to the edge of the right-hand door, and the third (C) shows a bead cut on the edge of each door. Such a bead may be formed with the aid

### Stock Bill for Bookracks

No. Pcs.	T.	W.	L.	Part
2	5/8	6 1/4	30	For Fig. 1.
3	5/8	6 1/4	19 3/8	Sides
2	3/4	10	35	Shelves
2	3/4	9 5/8	23 1/4	For Fig. 2.
1	3/4	6 1/4	23 1/4	Sides
1	3/4	23 1/4	32 3/4	Shelf
2	3/8	11 1/4	12 1/2	Back
2				Doors
2 pairs		3/4	1 1/2	Ball catches
2				Brass butts
2				Door knobs
2	5/8	7	36	For Fig. 3.
2	5/8	7	19 3/8	Sides
1	5/8	6	19 3/8	Shelves
1	5/8	5	19 3/8	Shelf
2	3/4	3	9 1/2	Drawer fronts
4	3/4	3	6 1/4	" sides
2	3/4	2 1/4	8 1/4	" ends
2	3/4	8 1/4	6 1/2	" bottoms
2				Knobs
2	3/4	7	26 1/4	For Fig. 4.
2	3/4	7	28 1/2	Sides
1	3/4	7	21 3/4	Shelves
3	1 1/2	1	24	Shelf
8	1 1/2	1	2	Hook stops,
				Keys

All dimensions are in inches.

of a marking gage and a piece of sandpaper. The spur of the marking gage should be sharpened so that it will cut a rather wide line or groove, after which the edges are rounded with the sandpaper.

The doors may be kept shut by means of ball catches let into the lower edges of each. If it is desired to lock the doors, a lock should be put on the right-hand door and a small flush bolt on the left-hand one.

A back may be fastened to the shelves after the bookrack is finished. A rabbet 3/8 by 3/8 in. must be cut for it, however, on the inside rear edges of the sides before the bookcase is glued up. The back may extend to the bottom of the case or stop behind the lower shelf. If a back is not desired, the

(Continued on page 93)

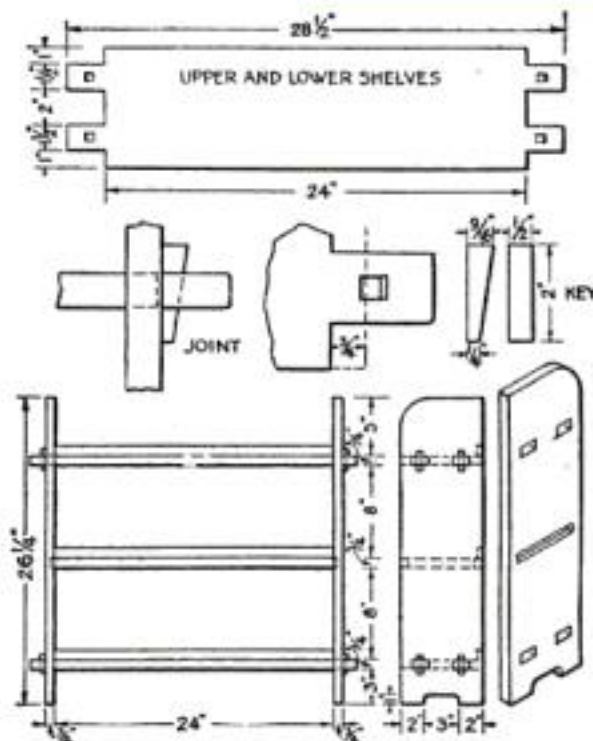


Fig. 4. A bookrack which comes apart so that it can be packed flat for shipment



APPROVED BY 18 MONTHS OF PUBLIC USE  
NO OTHER BATTERY IS LIKE IT



Eveready Layerbilt "B" Battery No. 486, the Heavy-Duty battery that should be specified for all loud-speaker sets. 45 volts.

The Layerbilt patented construction revealed. Each layer is an electrical cell, making automatic contact with its neighbors, and filling all available space inside the battery case.

## Practical tests show this to be the most economical type of "B" Battery

IN DAILY use in the home, Eveready Layerbilt "B" Battery No. 486 has fulfilled the promises made for it in laboratory tests. After more than a year's study of the performance of this battery in the hands of the public, we believe confidently that it is the most satisfactory and most economical "B" battery ever developed. All loud-speaker sets require Heavy-Duty batteries.

If you are now using the smaller, Light-Duty batteries, the Eveready Layerbilts will give you twice the service though they do not cost anything like twice as much. If you are already using Heavy-Duties, the Layerbilt, the longest lasting Heavy-Duty ever built, will run your set at least 25% longer, and again you will save money. Unless Eveready Layerbilts now are connected to your set, you spend more on "B" batteries than you should, and

you can have no idea how good a "B" battery can be. The Layerbilt holds a surprise in store for you.

Eveready Layerbilt's unequalled service is due to its unique construction. All other dry cell "B" batteries are made of cylindrical cells, with many soldered connections, and a great deal of space is wasted between the cells. The Layerbilt is built up of layers of flat current-producing elements, that make connection with each other automatically, and that fill all available space inside the battery case. It is every inch a battery.

In it you get more active materials than in any other battery and the Layerbilt construction makes those materials much more efficient current producers.

Those are the convincing reasons why the Eveready Layerbilt has proved itself the longest lasting,

most economical and reliable "B" battery ever built.

Just remember this about "B" batteries — Heavy-Duty batteries are more economical than the smaller Light-Duty batteries on all loud-speaker sets and the patented exclusive Eveready Layerbilt No. 486 is the most economical Eveready battery ever built.

Manufactured and guaranteed by  
**NATIONAL CARBON CO., INC.**  
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Tuesday night is Eveready Hour Night—9 P. M., Eastern Standard Time, through the following stations:

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WJAR—Providence	WWJ—Detroit
WEEI—Boston	WGN—Chicago
WTAG—Worcester	WOC—Davenport
WFI—Philadelphia	WCCO—Minneapolis
WGR—Buffalo	St. Paul
WCAE—Pittsburgh	KSD—St. Louis
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## Stands abuse and follows through



Use "Yankee" Bit Extension in a "Yankee" No. 2100 Brace—a combination of the two finest tools of their kinds.

"YANKEE" Bit Extension is *new*! Bit held by socket. No jaws to break. No loosening and pulling out of bit in work. No trouble to "follow through." And bit in "Yankee" Socket can't jam.

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Lengths: 15, 18, 21, 24 in.  
Full nickel-plate finish.  
Holds large range of bit shanks.

Ask your hardware dealer to show you this new "Yankee" Tool for saving time and labor. Write us for free "Yankee" Tool Book.

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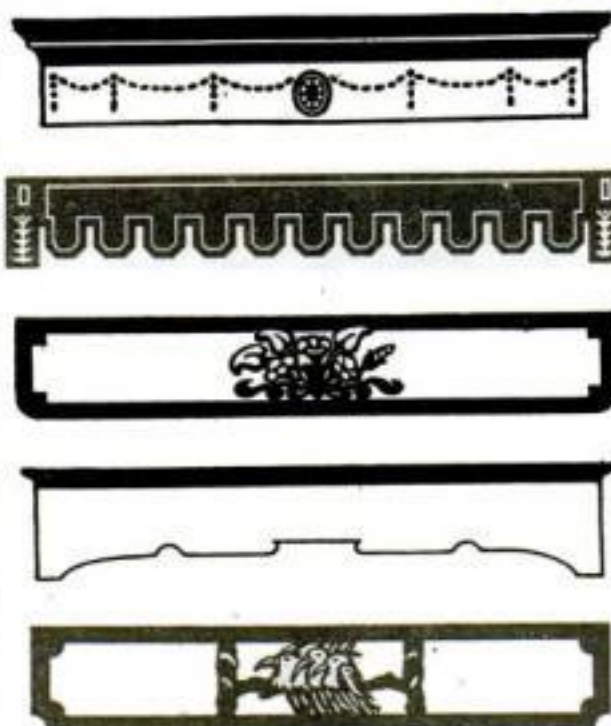
**"YANKEE" TOOLS**  
*Make Better Mechanics*



## The Home Workshop

### Valance Boards for Windows

(Continued from page 70)



Five more valances that suggest the many ways in which designs may be developed

nailed or screwed to each end of the valance boards and the whole is then ready to be screwed to the upper outside trim of the window after finishing. A rod for curtains may be screwed to the inside of the end pieces 2 in. above the lower edge.

The long valance board shown in the central illustration at the top of page 70 was made by a young man for a group of three windows in his mother's breakfast room. He used clear shellac on the board first. Then he transferred a dragon design in pencil and applied gesso to raise the ornament  $\frac{1}{8}$  in. above the background. The process of using gesso was well described in the April, 1926, issue of POPULAR SCIENCE MONTHLY.

The young man then painted the valance with Chinese red brushing lacquer, two coats being applied. Finally he went over the gesso with green gold outlined in black. The gauze window curtains are turquoise blue.

**A**N ATTRACTIVE guest bedroom that I saw recently in an English style suburban home has wooden window valances used with a finished effect. They hold a group of two windows on opposite sides of the room in harmony, one valance being used over each group. The shape is a plain rectangle with a raised molding—a triple line of gesso—slightly gilded. The background color is old ivory, on which are painted flat flower designs, one in the center and one toward each end.

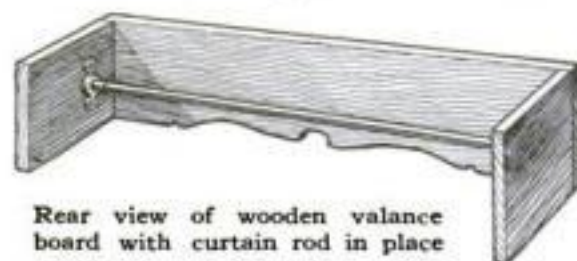
I recently helped a bride who wished to try a window valance made of wood painted to match her breakfast room. She copied an early American valance with a slightly curved lower edge.

After the valance board had gone through the preliminary process of sawing and preparation for painting, she painted the background with peacock blue lacquer. Then, after using two coats of

lacquer and allowing the last to dry overnight, she transferred a floral design by coating the back of her tracing paper with white chalk and tracing over the lines with a medium hard lead pencil. The design formed an oval medallion, 10 in. long.

Another very lovely pair of valances was made by a girl of sixteen for her room. She planned her boards for two single windows on opposite walls, one window being narrower than the other, thus requiring different sized boards. She painted the background tone a light gray-blue enamel to match the background of her draperies. She used three thin coats of enamel, after having first applied a good liquid filler or varnish. As enamels are apt to become marked unless perfectly dry, she waited a day for each coat to dry, and then several days after the last before she transferred her design on the board and painted it in gay colors.

Pictures of distinguished people mentioned in the early history of our country may be cut out, silhouette fashion, and painted black with opaque water color paints, or may be traced from old papers and painted black. These paper designs are glued to the center of the valance boards after a background tone has been



Rear view of wooden valance board with curtain rod in place

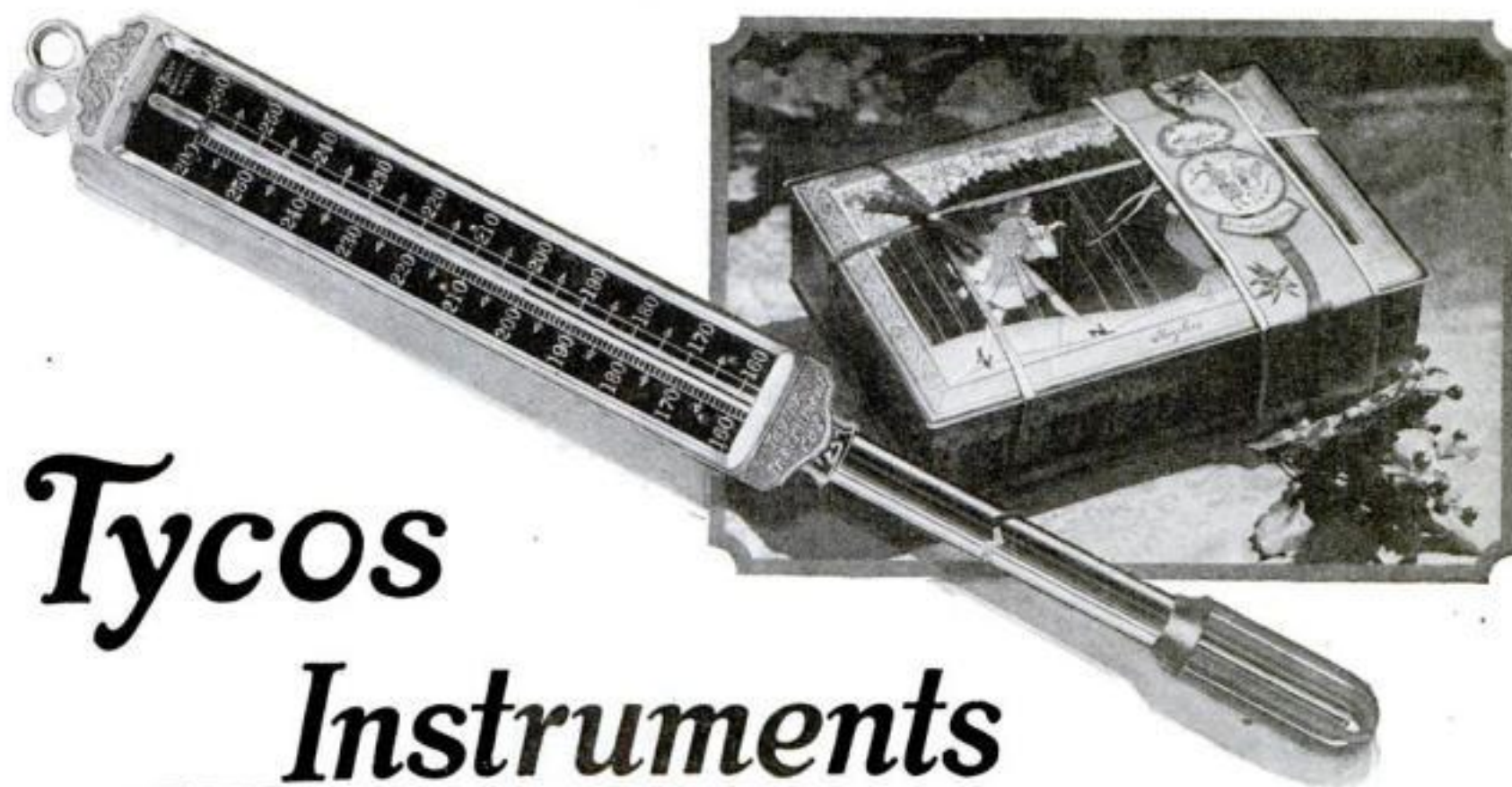
painted. Then a decorative border of black may be painted around them so that the effect is like an old miniature medallion painted on wood. The whole surface of the valance should receive a flat coat of white shellac or of transparent varnish afterward.

Gay colored birds may be cut from wall paper or curtain material and applied as a decoration.

Designs worked out with a keyhole saw are quite effective, as their height above one's eye level in a room makes them resemble open lacelike patterns in old architectural wood carvings. A stock molding may often be used for the upper edge of the valance as a good decorative finish. If one has skill as a craftsman and cares to make his wood valance a more elaborate affair, he may carve and stain it, using gumwood, oak or white pine.

A charming French wood valance in a blue-and-ivory bedroom has rounded corners representing the Greek acanthus leaf; this is carved and gilded in relief. Five-sided oblongs are repeated with a notched effect along the lower edge of the valance. Light blue-green silk overdraperies fall in graceful folds to the floor.





# Tycos Instruments

## Tycos - for the Home



**Tycos Office Thermometers**  
An aid in promoting human efficiency.

**Tycos Bath Thermometers**  
To enable you to get the most good from your bath.

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## Help to Maintain the Quality of *Huyler's* Candies

*Says Their Manager of Production*

THE NAME HUYLER'S has always stood for quality and purity in our chocolates, ice cream and other confections. This is what the public expects from us and it is what the public always gets.

To help us maintain the quality and purity of our products we started using Tycos Instruments some four years ago.

The materials contained at one time in one of our holding tanks are worth \$300 or more. Spoilage was always a possibility before Tycos equipment was used but none has occurred since installing their splendid heat indicating and recording devices. This represents a definite money saving—but what is even more important our stores and customers are never disappointed by delays due to spoilage.

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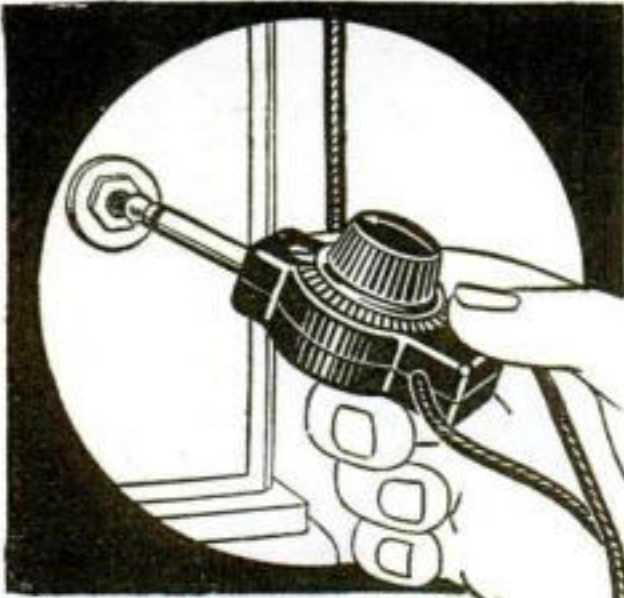
THE SIXTH SENSE OF INDUSTRY

# Tycos Temperature Instruments

INDICATING • RECORDING • CONTROLLING







## Brings Your Set Up To Date

### Enjoy the NEW Tone Volume Improvements With Your Present Set

Tone performance is featured as the outstanding innovation in this year's best new sets. You can enjoy this tremendous improvement with your present receiver. Centralab Modu-Plug is especially for that purpose. Remove your loud speaker plug—replace with Modu-Plug—and you will get this new, easy, sure control of tone volume.

## Centralab Modu-Plug

Tune in your station on the set, then modulate the tone volume with the Modu-Plug to the exact point of greatest distinctiveness and most pleasing reception by simply turning the small knob on the Modu-Plug. In this way you transfer the final touch of tuning to the Modu-Plug between the set and the speaker, and you avoid the exasperation of frequently losing a good station or distorting reception by moving the dials to get the right tone volume.

Modu-Plug is truly invaluable to give you just the sure, easy tone volume control that you have always wanted.

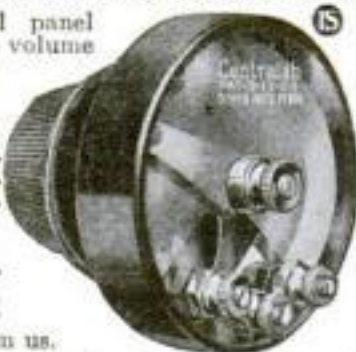
### Jack Type—Cord Type

Centralab Modu-Plug standard type is for sets with one or more jacks. The cord type is for sets without jacks and has phone cord for insertion between speaker and output binding posts. Also suitable as a remote control of receiver, and to operate two or more speakers from your set.

Either type, \$2.50 at dealers, or mailed direct for trial with money refunded within 10 days if returned not satisfactory.

### Centralab Modulator

The ideal panel mounted tone volume control for any circuit. Standard on many leading sets. Specified by Thorndarson, Samson and other manufacturers of quality amplifiers. \$2.00 at your dealers or from us.



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# Centralab

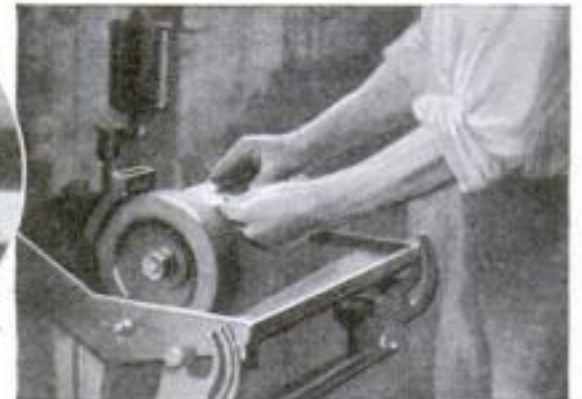
## The Home Workshop

# Your CHISELS and PLANES

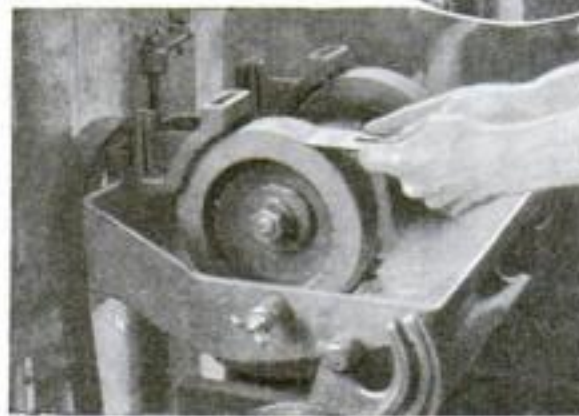
## How to Keep Them Sharp—Grinding and Whetting

By EMANUEL E. ERICSON, *Noted Manual Training Authority*

**1** Better and faster work can be done when plane irons and chisels are kept sharp. The first step in sharpening is to test the edge for squareness with a try-square



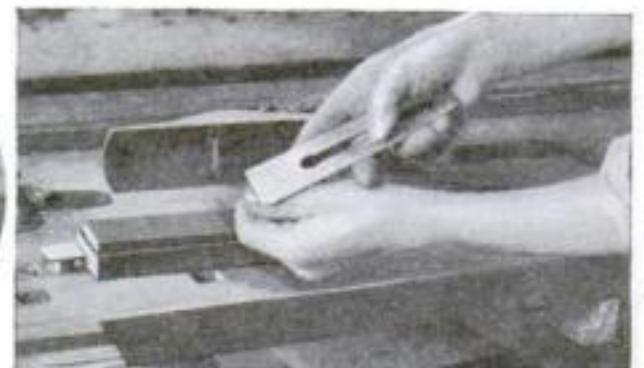
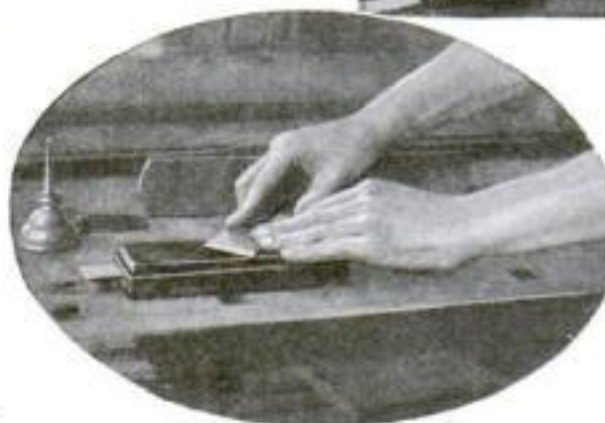
**2** Grind the cutting edge straight and square by holding it against the side of a tool-grinding wheel



**3** A power grinder, small hand wheel, or common grindstone may be used. The tool can be held with or without the aid of a support. The bevel angle ranges from 15 deg. for soft wood to 20 deg. for hard wood



**4** The fine "wire edge" left by grinding may be pulled off by making a slanting cut in a bit of soft wood. The finishing is done on a fine oil-stone, upon which a few drops of oil have been placed. Hold the bevel flat on the stone and rub either with a circular or a back-and-forth stroke



**5** Turn the plane iron or chisel over and lay it perfectly flat on the stone as shown. Take a few strokes back and forth to remove the fine "wire edge." Stroking the edge through a piece of soft wood may again be necessary, and sometimes the entire whetting process will have to be repeated for best results

**6** Test the tool for sharpness by letting it bite on the thumbnail. If it does not catch on the nail when resting with only its own weight, it is not properly sharpened. The final stropping is sometimes given on leather. Mechanics often strop the edge a few times in the palm of the hand to give a final finish

### Applying Roofing Cement

**W**HENEVER too much roofing cement is used in applying roll roofing, some of the surplus cement is apt to melt and run down the roof, making unsightly streaks. It is so hard to avoid getting too much cement in the joints

that the cement is often omitted entirely. A good way to regulate the cement is to punch two holes in the top of the can and pour it out just as if it were condensed milk. I have found this method not only cleaner and easier than applying the cement with a brush, but also quicker and more economical.—M. J. HEFTI.



**W**hen the tree is  
trimmed for the great day—when the  
peace and good cheer of  
Christmas are almost here  
—have a Camel!



Camels represent the utmost in cigarette quality. The choicest of Turkish and Domestic tobaccos are blended into Camels by master blenders and the finest of French cigarette paper is made especially for them. No other cigarette is like Camels. They are the overwhelming choice of experienced smokers.

WHEN the stockings are hung by the mantel. And the children's tree is ablaze with the gifts and toys for tomorrow's glad awakening. When joyously tired at midnight you settle down by the languishing fire — have a Camel!

For to those who think of others, there is no other gift like Camels. Camel enjoyment enriches every busy day, increases the gladness in giving, makes life's anticipations brighter. Before Camel, no cigarette ever was so good. Camels are made of such choice tobaccos that they never tire the taste or leave a cigaretty after-taste.

So on this Christmas Eve, when your work for others is done — when you're too glad for sleep with thoughts of tomorrow's happiness — have then the mellowest—

*Have a Camel!*



Remember your few closest friends with a supply of Camels for Christmas Day and the days to come. Mail or send your Camel cartons early, so that they will be delivered in ample time.

R. J. Reynolds Tobacco Company  
Winston-Salem, N. C.



Contrast the clumsy dials of only two years back... with the handsome illuminated controls MAR-CO makes today. Here is another good reason for building your set yourself!



## Now dials give place~ to glowing spots of light

**P**ICTURE a soft, subdued light in the room...

- your set in the corner ~ with glowing spots of light illuminating its swiftly readable *back panel* scales.
- this is radio at its handsomest...
- this is the panel arrangement, the type of skillful tuning, that distinguishes the 1927 trend in set construction.

Already, these new MAR-CO controls are specified or optional equipment in a score of this season's most advanced circuits. At once, they have become the standard in tuning control design. Use them, in whatever set you build, to give the final touch of style, and the utmost in precision control.

MAR-CO controls are easy to install. The steel template pro-

vided reduces panel-drilling to the simple, fool-proof operation illustrated below. The original MAR-CO "friction-drive"—the action that makes backlash impossible—has been strengthened, to accommodate gang condensers. The MAZDA lamp supplied runs on your "A" battery, using only .1 ampere. The switch that controls this lamp may also be used as your filament switch, the lighted scales then serve as pilots. Scales read 0 to 100, or 100 to 0, as preferred. Price, including template, bulb, and bezel, \$3.50. Replacement bulbs, \$.20. Write today for the booklet that illustrates 15 standard makes of condensers mounted on MAR-CO back-panel controls. Martin-Copeland Company, Providence, R. I. Branch offices and representatives in principal cities.

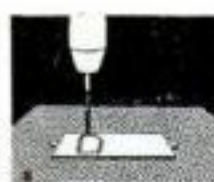
The VARION,  
The L. C. 27,  
The INFRA-DYNE,  
The R. B. LAB,  
The MADISON-MOORE,  
and over a dozen more of the season's most advanced circuits, specifically call for MAR-CO Controls.

## MAR-CO *Illuminated* Controls

Here's how  
you drill  
the panel..



Screw Template  
to panel



Drill holes  
through Template



Remove window  
opening



Bezel covers  
rough edge

that's ALL,  
you CAN'T  
go wrong!



## The Home Workshop

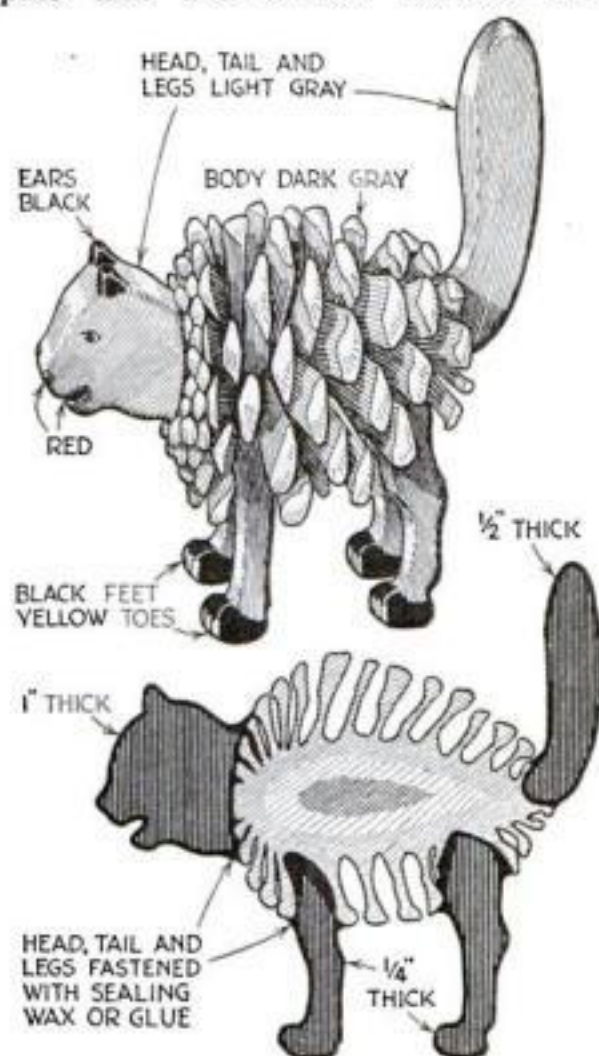
Pine-Cone Cat  
"Comicull"

By F. CLARKE HUGHES

MANY interesting toys, like the cat illustrated, may be made from pine cones and a few bits of wood.

To make a cat, select a cone that is as nearly as possible the shape indicated in the accompanying drawing. The size of the head, legs and tail will be regulated by the shape and size of the cone.

The parts should be sawed from soft pine and the corners rounded and



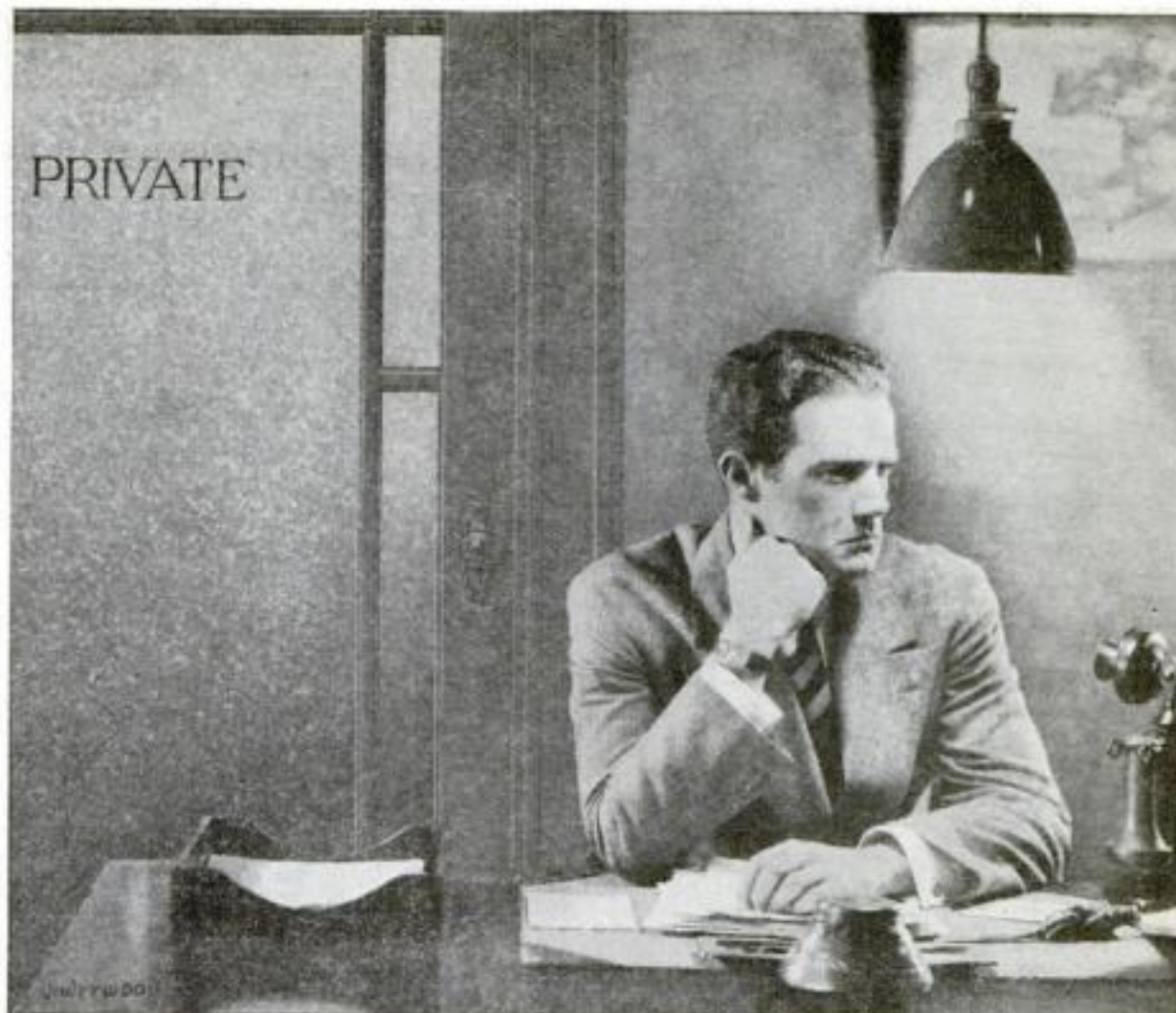
The head, legs and tail are cut from soft wood and fitted carefully to the pine cone

smoothed. Each should then be fitted to the cone and fastened with either glue or sealing wax. All the space between the wood and the cone must be filled to insure tight joints.

It is suggested that the body be painted with dark gray enamel having a gloss finish. The head and tail may be a lighter tone of the same color, and the feet of a contrasting enamel, such as black or white. For the nose and mouth, bright red is a good color; the eyes are black, relieved with a touch of white.

## The Prize Winning Name

"COMICULLS," from the words "comic" and "culls," was the best name submitted in the recent contest to designate the little novelties that Mr. Hughes is describing from month to month. It was suggested by John H. Wack, of Pittsburgh, Pa.

Held back by—what?  
—perhaps it's comedones\*

FOR five years he had watched men come and go—up to better jobs. He knew he was not stupid. Something kept him back. Something made them promote other men— younger men. What could it be?

It is unfortunate that many men suffer from comedones—the scientific name for blackheads. These disfiguring blemishes keep you from being clean-cut and attractive. They are often responsible for lack of business success. For while you yourself may not be conscious of them, others notice them. You may have wondered why success never comes. Perhaps it's comedones.

Pompeian Massage Cream helps you overcome comedones. It gets in where comedones form, rolls out all dirt and oily secretions. It stimulates a healthy circulation, keeps the pores

open, and gives you a clean, ruddy complexion.

## Try this treatment

After you shave, spread Pompeian Massage Cream generously over your face—and rub. Continue to rub until the cream rolls out. Note how dark the cream looks. That's the dirt that was in your pores.

Don't let comedones form. Use Pompeian Massage Cream every day—especially when social or business engagements demand that you look your best. It means a healthy, wholesome skin. It means more joy in living.



## \*WHAT ARE COMEDONES?

(pronounced cōm'e-dōnes)

Dictionary definition: A small plug or mass occluding the excretory duct of a sebaceous gland, occurring frequently upon the face, especially the nose. It is often called blackhead.

## Use at Home after Shaving

To get full pleasure and benefit, use Pompeian Massage Cream regularly at home after shaving. Your face will feel and look like a million dollars. 60c jars at all drug stores.

SEND FOR  
10-DAY TRIAL TUBE

For Men!

For 10c we will send a special trial tube containing sufficient cream for many delightful massages. Positively only one trial tube to a family on this exceptional offer. Use this coupon now.

## TEAR OFF NOW! YOU MAY FORGET

The Pompeian Laboratories,  
Dept. 30, Cleveland, Ohio

Gentlemen: I enclose 10c (a dime, coin preferred) for a special trial tube of Pompeian massage cream.

Name.....

Street Address.....

City..... State.....



ASK... ANY... RADIO... ENGINEER



## With the "Trouble-Shooters" of the North Atlantic

**ICE-BERGS**—towering, ponderous, deadly mountains of ice drift southward from the ice fields of the Arctic into the traffic lane of trans-Atlantic steamers.

Locating and destroying them is the perilous and never-ending duty of the United States Coast Guard Cutters.

Shell fire and high explosives, however, often fail to blow the bergs from the sea, and warnings are then broadcasted by radio to every ship whose course lies through the danger zone.

Smooth power, unfailing dependability over long periods and under all conditions of service are qualities demanded in the radio batteries used in this dangerous naval service.

The fact that Burgess Batteries meet those requirements recommends them to you for your own receiving set.

Ask Any Radio Engineer

**BURGESS BATTERY  
COMPANY**

GENERAL SALES OFFICE: CHICAGO

Canadian Factories and Offices:  
Niagara Falls and Winnipeg



# BURGESS RADIO BATTERIES

## The Home Workshop

### What Electric Fuse to Use—and Why

By GEORGE A. WILLOUGHBY

Supervisor of Electric Work, Arthur Hill Trade School, Saginaw, Mich.

"I PUSHED the switch to start the washing machine and the motor made a sound as it usually does for a second or two. Then it stopped. What do you think the matter is?"

This was the question that greeted me when I arrived home for luncheon one day recently.

"That sounds like a fuse rather than motor trouble," I said.

"But I just put in a new one yesterday," my wife objected, "and you wouldn't think it would blow again right away."

We went down to look at the fuse block and, after removing the blown fuse, found that it was marked "6 amp."

"No wonder it blew!" I exclaimed.



A "blown" fuse which has been broken apart to show the gap in the fusible wire

"This was intended for my rectifier and you must have put it in without looking at it. What we want is one marked fifteen amperes."

I explained that all the current drawn through the fuse block has to pass through a tiny strip of metal within each fuse. A certain amount of current melts the metal and opens the circuit. This is the automatic safeguard that protects all house lighting circuits.

The protection a fuse affords is essential, because if too large a current is forced through the house wires or any current carrying parts of electrical devices, they will get hot and perhaps burn up or set fire to their surroundings. Then, too, it is much cheaper to replace a blown fuse than to repair a burned-out motor or other device.

A fuse marked "10 amp. 125 V." is suitable for use in the ordinary house lighting system of 110 volts and will carry ten amperes without blowing. If anyone should put a penny or a piece of wire under the fuse—a common but hazardous trick—there is practically no limit to the current which can flow.

The number of amperes required by many electrical devices is stamped on the name plate. The nearer the capacity of the fuse is to this value, the greater will be the protection. The National Board of Fire Underwriters has specified fifteen-ampere fuses as the largest capacity permissible for ordinary house circuits.

## TEST YOUR BATTERY with a

**BATTERY GA-JIT**

REPLACES MESSY HYDROMETERS

**\$1.25**

FOR TESTING General Instrument New York

No Radio or Auto Complete Without One No more spilling of acid. Battery Ga-Jit replaces the messy acid spilling hydrometer and tests your battery in a second.

At Your Dealer's If he can't supply you send price and we will forward one, postpaid.

**General Instrument Corporation**

477 BROADWAY NEW YORK, U.S.A.

## Imperial Sanitary Floor

Put on like Plaster Wears like Iron

waterproof fireproof resilient noiseless dustless

Base and Floor one solid piece

A composition material easily applied in plastic form over practically any kind of floor. Laid about 1/8 inch thick, Imperial Floor does not crack, peel or come loose from foundation. A continuous, fine grained, smooth, non-slipping surface. No crevices to gather grease, dirt, dust, disease germs or moisture.

Ideal Floor for Kitchen, Pantry, Bath Room, Laundry, Porch, Garage, Restaurant, Theater, Hotel, Factory, Office Building, Railroad Station, Hospital—wherever a beautiful, substantial floor is desired. Several practical colors. Full information and sample FREE of your first and second choice of color.

**Imperial Floor Co., 73-77 Halstead St., Rochester, N. Y.**

A Success for 15 Years

## SEE WITHOUT GLASSES!

NEW INVENTION and NEW KNOWLEDGE of the EYE MAKE IT POSSIBLE

THE BARRETT EYE NORMALIZER is the new invention which makes it practical for you to use this NEW KNOWLEDGE in your own home and thereby retain or regain normal eyesight.

The beautiful illustrated booklet on "Better Eyesight—Unhampered by Glasses" will be mailed FREE upon request. It may answer your question: "What Shall I Do For My Eyes?" Send for it today.

**THE BARRETT INSTITUTE**

1388 Pershing Square Building Los Angeles, California

## A 2c Stamp

—will start you on the road to success. See Money Making Opportunities on pages 114 to 142.



# Better Reception



## Majestic "B" Current Supply

delivers pure direct current from your light socket

### Majestic Standard-B

Capacity seven tubes or six plus 1 power tube. 45 milliamperes at 135 volts

**\$32.50**

West of Rocky Mts., \$35.00

**Majestic Super-B**  
Capacity one to twelve tubes, including the use of power tubes. 45 mils at 150 volts. **\$35.00**

West of Rocky Mts., \$37.50 (AS ILLUSTRATED)

### Majestic Master-B

For Radiola 25, 28, 30 and Super heterodynes. Operates power tubes. 60 mils at 150 volts.

**\$42.50**

West of Rocky Mts., \$45.00

### No Hum—A Superior Source of Power

The voltage can always be accurately adjusted to meet the varying conditions of every city and on any set.

Economical—cost a fraction of a cent per hour. No acid or liquids; Uses Raytheon Tube; No filament to burn out.

See your dealer today. Insist on a demonstration on YOUR set immediately

(Can be purchased on deferred payments)

**GRIGSBY ~ GRUNOW ~ HINDS ~ CO. 4578 ARMITAGE AVE. CHICAGO-ILL**





## "D. Maydole"

If you know and appreciate fine tools, you don't have to be told what "D. Maydole" means on a hammer head.

Three generations of hammer users know that Maydole Hammers are as fine as eighty-three years of experience, press-forged tool steel and clear, second-growth, air-dried hickory can make them.

The minute you take a Maydole Hammer in your hand, you'll know by the "hang" that it's *your* hammer.

Ask your dealer to show you the style and size you prefer.

And write us for interesting and useful Pocket Handbook 23 "B."



YOUR HAMMER SINCE 1843  
**Maydole**  
**Hammers**

The David Maydole Hammer Co., Norwich, N.Y.

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## The Home Workshop

### Decorating with Plastic Paint

(Continued from page 68)



Semicircular sweeps of a 4-in. wall brush produced the so-called monastic texture

covered with brush marks. A ceiling is not so easy as a wall to do, but we had finished with ours under three hours. In order to get the best effect, however, we went over walls and ceilings after they were thoroughly dried, and with a piece of sandpaper "softened" the "welts" that seemed too sharp. Then, because Eleanor—rightfully enough—wanted them washable, we gave the walls and ceilings a coat of size.

The finished job exceeded our anticipations. We had walls and ceiling of different but harmonious tints. We had rough textures that broke up light waves and that diffused a soft glow through the room. And our furniture had an interesting and effective background. In short, we had got out of the commonplace and into the unusual. And, of course, Eleanor said: "There, didn't I tell you." I feared then that I was in for the job of redecorating the whole house.

The dining room was the next point of attack. There the problem was complicated by the fact that the walls had been papered. I have heard of plastic paint jobs over wall paper. Some were satisfactory, but not all. In our case we had determined to do a thorough job. So we removed all the wall paper. Then the entire surface was washed down with a solution of sal soda and hot water. Cracks in the wall were filled with the joint finisher (or patching plaster) used with mineral wallboard, and then sandpapered. It was not necessary to apply a coat of size.

WE HAD decided on an Italian texture for the walls of the dining room, because of the certainty of its harmonizing with the Spanish texture of the living room. The color chosen was turquoise blue, with the ceiling lighter than the walls and finished in the monastic texture used in the living room. The pigment and paint were mixed just as before and the Italian texture was developed by leaving large brush marks showing as the plastic paint was applied. As I went ahead with the brush, Eleanor followed behind and smoothed down the brush marks with sweeping strokes of the palm and heel of her hand.

We had improved our technique considerably as a result of our experience in decorating the living room and were able, as a consequence, to finish the dining room walls in the short time of five and a half hours. For some reason—perhaps because we dawdled to admire our handiwork—the dining room ceiling took a half hour longer than that in the living room.

The kitchen was next. There the calcimine was in truly bad condition and we began by washing all the color off, being particular to leave no color in the corners or around the trim. Finding the cleaned surface glossy, we washed it down with steel wool and a strong solution of hot sal soda water. Another washing—with clear water—was necessary to remove all traces of alkali and steel wool. We then let the surface dry before scratching it thoroughly in every direction. We now were ready for the application of the plastic paint.

We had decided on pure white walls and ceiling for the kitchen and a stipple finish, such as is found in many old Colonial homes. Therefore, it was not necessary to color the plastic paint. We merely mixed it to a thick consistency and brushed it on, letting it "set" slightly before we produced our stipple by dabbing the wall all over with a painter's ordinary stippling brush.

THE ceiling was treated in the same manner. Our actual working time with the plastic paint, for walls and ceilings, was just over five hours, although we spent an equal time getting the walls and ceilings ready, an hour in lightly



The Italian texture, which is copied after a finish found in many fine old Roman villas

sanding our stipple to remove sharp points, and two hours in "sizing" the finished wall.

For the hallway and the three other rooms in the house we used texture and color-tone effects that were different from one another and from the ones already described. How these were produced, and a description of some small art objects made with plastic paint, will be the subject of a following article.



## The Home Workshop

### Full Size Drawings for Constitution Model

THREE blueprints giving full size details for building a decorative model of the U. S. frigate *Constitution* are added to our list this month. For a description of this model see page 67. Plans for three other ship models are available, a pirate galley (Nos. 44 and 45), a gorgeous Spanish galleon (46 and 47), and a clipper ship (51, 52 and 53).

### Complete List of Blueprints

ANY ONE of the blueprints listed below can be obtained from POPULAR SCIENCE MONTHLY for 25 cents. The corresponding back issue of the magazine, in which the project was described in detail, can be had for 25 cents additional so long as copies are available. The Editor will be glad to answer any specific questions relative to tools, material, or equipment.

POPULAR SCIENCE MONTHLY  
250 Fourth Avenue, New York

GENTLEMEN:

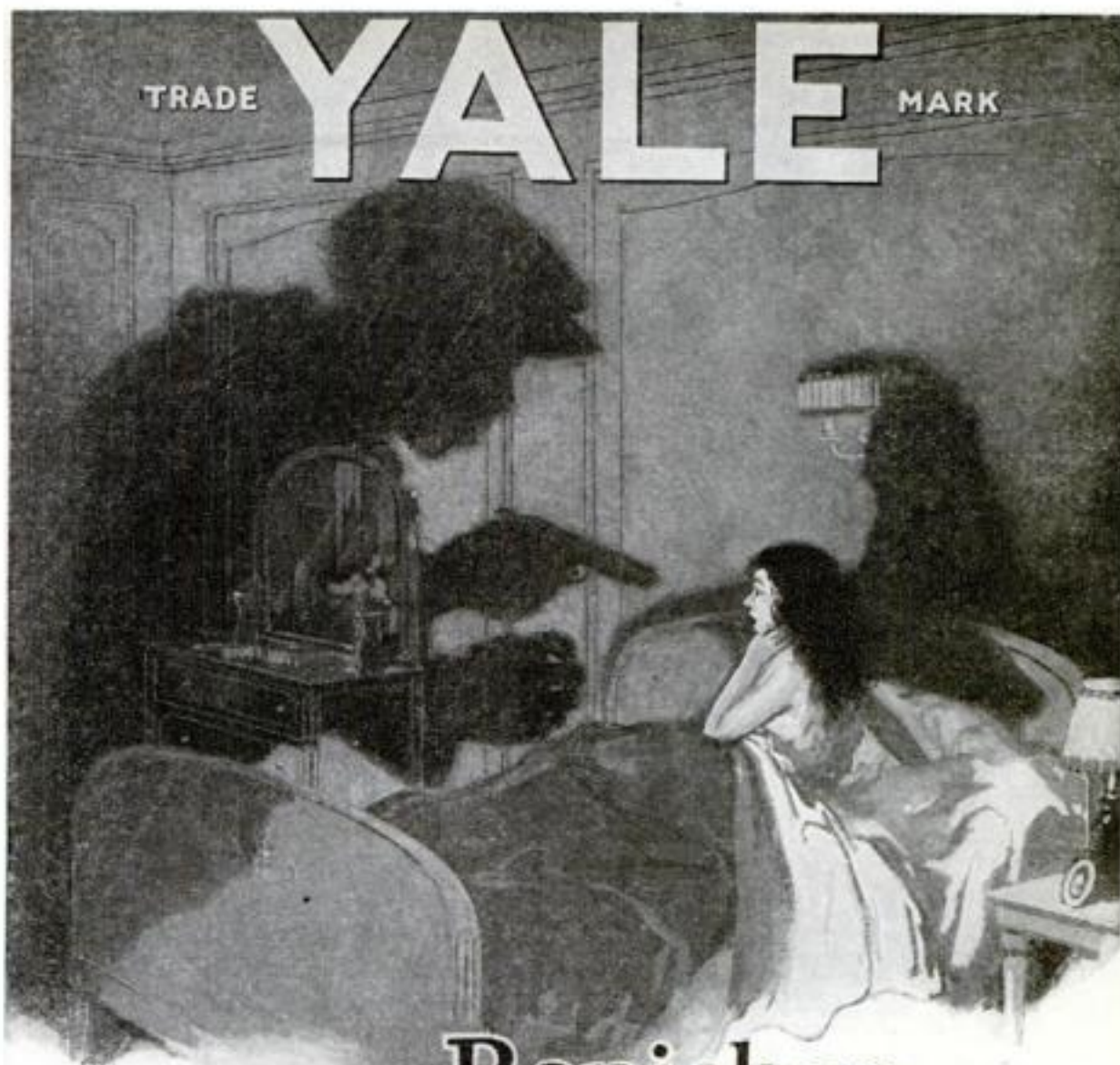
Send me the blueprint, or blueprints, I have underlined below, for which I inclose.....cents:

No.	Title	Described in Issues of	Price
1.	Sewing Table	Feb., '22	25c
2.	Smoking Cabinet	Mar., '22	25c
3.	End Table	Apr., '22	25c
5.	Kitchen Cabinet	May, '22	25c
8.	Shaving Cabinet	June, '22	25c
9.	Arbor, Gate and Seats	July, '22	25c
10.	Porch Swing	Aug., '22	25c
11.	Bench and Tilt Table	Sept., '22	25c
12.	Electric Washer	Oct., '22	25c
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24.	Gateleg Table	June, '23	25c
25.	Canoe Sailing Outfit	July, '23	25c
26.	Baby's Crib and Pen	Sept., '23	25c
27.	Kitchen-Cabinet Table	Oct., '23	25c
28.	Pullman Play Table	Nov., '23	25c
29.	Toy Tea Cart, etc.	Dec., '23	25c
30.	Tool Cabinet, etc.	Jan., '24	25c
31.	Sewing Cabinets	Feb., '24	25c
32.	Chinese Game Table	Mar., '24	25c
33.	Dining Alcove	Apr., '24	25c
34.	Garden Trellises	May, '24	25c
35.	Simple Radio Cabinet	Oct., '24	25c
36.	Rush-Bottom Chair	Nov., '24	25c
37.	Simplified Bookcase	Dec., '24	25c
38.	Sheraton Table	Jan., '25	25c
39.	Salem Chest	Feb., '25	25c
40.	Desk in Sheraton Style	Mar., '25	25c
41.	One-Tube Radio Set	May, '25	25c
42.	Three-Stage Amplifier	June, '25	25c
43.	Four-Tube Receiver	July, '25	25c
44.	Pirate Ship Model—Hull	Feb., '26	25c
45.	Pirate Ship—Details	Mar., '26	25c
46.	Galleon Model—Hull	May, '26	25c
47.	Galleon Model—Details	June, '26	25c
48.	Sailing Yacht Model	July, '26	25c
49.	Broom Cabinet	Aug., '26	25c
50.	Airplane Model (Flying)	Sept., '26	25c
51.	Clipper Ship Model—Hull	Oct., '26	25c
52.	Clipper Model—Details	Oct., '26	25c
53.	Clipper Model—Rigging	Nov., '26	25c
54.	Five-Tube Radio Set	Oct., '26	25c
55.	Five-Tube Set—Details	Oct., '26	25c
56.	Bird and Animal Toys	Dec., '26	25c
57.	Constitution Model—Hull	Jan., '27	25c
58.	Constitution—Rigging	Jan., '27	25c
59.	Constitution—Rigging	Jan., '27	25c

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(Please print name and address very clearly)

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City and State.....



# Banishes

# Fear!

from your home

Night loneliness... the sound of stealthy tampering at the door... a moment of helpless terror... *Has she forgotten to lock it?*

But the Yale 44 Automatic Deadlatch needs no remembering. When you shut your door, the heavy square latch bolt is *automatically* thrown nearly twice the usual distance into the strike and deadlocked!

Thus it is proof against forgetfulness from within and violence from without. It cannot be left unlocked. It does automatically what you might forget to do manually.

Be sure you have the right locks on all your entrance doors.

Look for the Yale trade-mark. If it's *marked* Yale it's *made* by Yale. No other locks are Yale.

Send for booklet,  
"Let the Yale 44 Automatic Protect You"

The Yale & Towne Manufacturing Co.

Stamford, Conn., U. S. A.

Canadian Branch at St. Catharines, Ont.

YALE MARKED IS YALE MADE



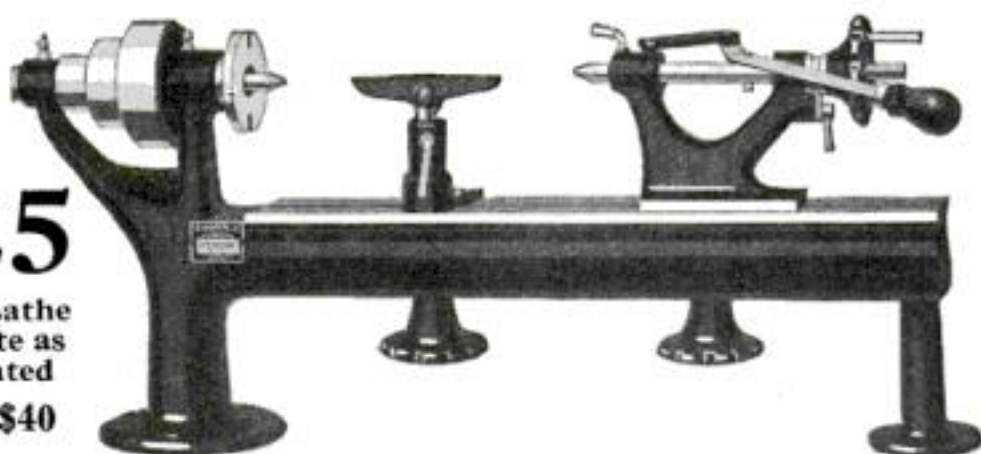
Yale 44  
Automatic  
Deadlatch



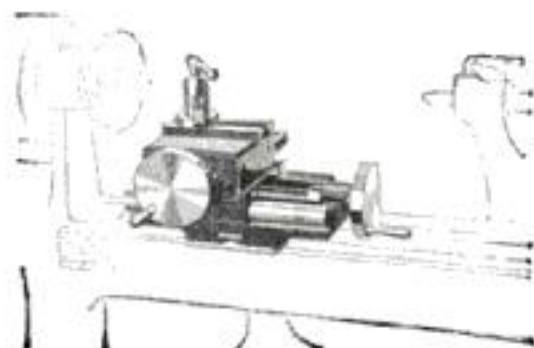


No.  
**125**

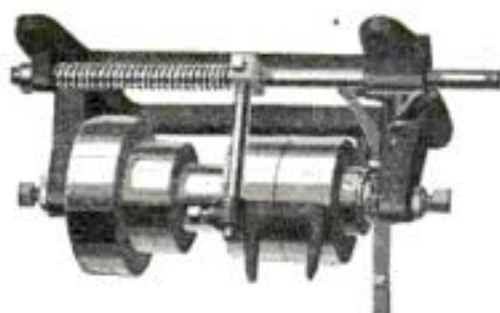
Bench Lathe  
Complete as  
Illustrated  
Price \$40



**This bench lathe  
makes your home shop  
a real workshop**



No. **132** Slide Rest  
Price \$17.50



No. **130** Counter Shaft  
Price \$12

**T**HERE are many turning and boring jobs you could do yourself if you had a bench lathe. Make your workshop more complete by adding to it this Goodell-Pratt Lathe. It enables you to do professional-looking work. Over-all length of this bench lathe is 25 inches; height, 11½ inches; swing, 7 inches; extreme distance between centers, 12 inches. It weighs only 30 pounds.

This lathe has a milled bed and a tail stock with milled base. Live spindle has a cone bearing to take up wear. The tail stock has both screw and lever feed. Cone pulley has 3 steps—1½, 2½, 3½ inches in diameter. The lathe is finished with black and red enamel. All working parts are beautifully polished.

A complete line of attachments is available to fit this lathe. Among them are a slide rest, lathe tools, compression check and collets, milling attachments, turret attachments.

### Bench Lathe No. 494

This lathe has the same construction as No. 125 above, but is slightly larger. Length over all, 31 inches; height, 11½ inches; swing, 7 inches; extreme distance between centers, 18 inches. Net weight, 36 pounds. Price \$44.

### 400-page Book of Tools FREE

A postcard will bring you the 400-page pocket-size book of all the famous 1500 Goodell-Pratt tools. In this book are shown and described many tools you will want to outfit your workshops completely. Every tool shown is beautifully made and finished by skilled toolmakers. Just let us know where to send your copy of the book. It is FREE.

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Makers of Mr. Punch

**GOODELL-PRATT**  
1500 GOOD TOOLS

## The Home Workshop

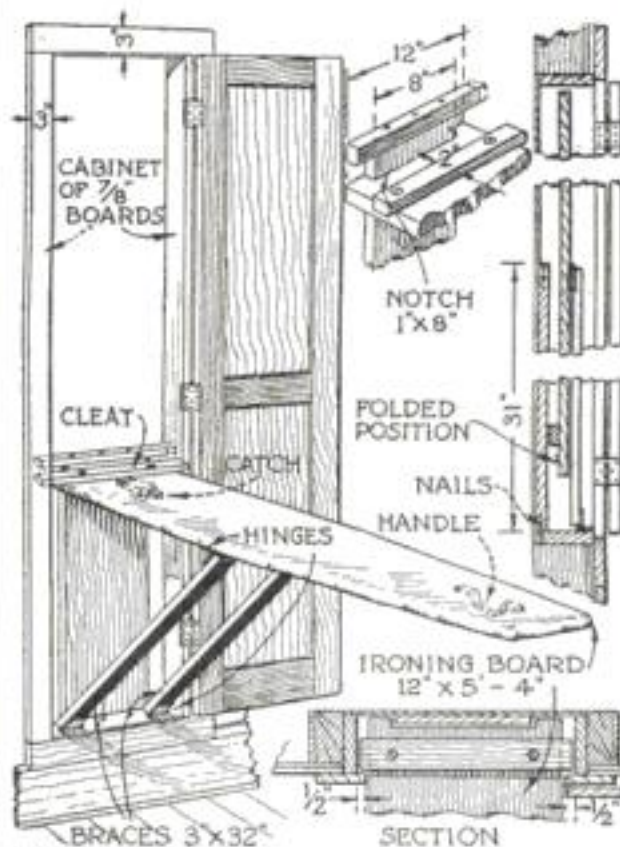
### Foolproof Built-In Ironing Board

By T. M. ANDERSON

**T**O DRAW out the ironing board illustrated, it is necessary only to pull it down from the top. It automatically raises at the base and slides into position, where it remains firmly fixed. There are no loose props or legs to give trouble.

The board is built in a cabinet between two wall studs, which are commonly about 16 in. apart. The cabinet has ¾-in. pine sides and a wallboard back. A 3-in. facing is used to case the cabinet; this leaves an opening for the door of about 14 in., which admits an ironing board 12 in. wide. It should be noted that the casing is not set flush with the cabinet sides; it extends over them at least ½ in.

In the base of the ironing board, which should be 5 ft. 4 in. long, cut a notch 1 in. deep and 8 in. wide, as shown in the de-



The ironing board open for use; details of the strong and simple folding mechanism

tail at the top of the accompanying illustration. Place a board 8 by about 31 in. in the back of the cabinet at the bottom, nailing it from the bottom. Then nail a 1 in. square strip across the top and through the sides of the cabinet. This determines the height of the ironing board when open and should be arranged to suit the stature and preferences of whoever is to do the ironing. A favorite height is 31 in. from the floor. After these parts are in place, set the cabinet bodily between the studs and nail it firmly to the studding.

The notch in the ironing board should fit the board in the back of the cabinet so that the ironing board can slide up and down freely. Cut a 2 in. wide strip as long as the inside width of the cabinet and fasten it to the ironing board from the top side as shown. Round this on one edge and sandpaper it well. It should be placed so that it (Continued on page 87)



## The Home Workshop

### How to Glue Wide Boards Together without Clamps

ANY home worker who wishes to join two wide boards for making a table top or something of that sort, and does not have the clamps necessary for doing the job with glue in the ordinary way, may find helpful a method that I have practiced at times with excellent results.

Plane the edges of the boards straight and square, apply liquid glue to both edges to be joined, and place the boards together face down on a bench or level floor. Raise the outer edges on thin pieces of wood so that the face side of the joint will be slightly open and the back edges closed. Then drive corrugated fasteners across the joint at intervals of from 8 to 12 in.

Turn the boards over and place strips under the outer edges so as to raise the whole slightly and leave the joint clear of the bench. Lay sufficient weights on the face of the boards to draw the joint tight and let them stand as if it were in clamps.

The corrugated fasteners hold the joint tight from the back and the weights insure a perfect fit on the face.

Hot glue, of course, cannot be used in this process as it hardens too quickly. The glue I have used exclusively for years in conducting a picture framing and general furniture repair shop is made by pouring enough apple vinegar over the best obtainable grade of brown flake glue to cover it. The container is placed in the sunshine or a warm room and stirred occasionally.

After twelve hours the glue is ready to use. If it becomes too stiff at any time, the receptacle is either placed in the sun or in a basin of hot water for a few minutes. It is used at the same consistency and in the same way as ordinary hot glue, but it does not dry so quickly and does not decompose.

If the glue is not to be used for several days, I make it a practice to pour a little vinegar over it and put the container in a cool place.—R. C. STANLEY.

### Foolproof Ironing Board

(Continued from page 86)

will slide up and down against the inside of the facing, which was allowed to extend over the cabinet sides  $\frac{1}{2}$  in. for this purpose. The board should now move up and down, but not backward or to either side.

For the braces use two strips 3 in. wide and about 32 in. long. Fasten with two pair of 2 in. square, loose-pin hinges. One pair of hinges is fastened to the inside base of the cabinet, as near the outside edge as will allow the door to close. The other hinges are so placed on the board that it will be held level when fully extended.

On the under side of the board at the back is placed a spring catch such as is used on the cabinet door. This catches in a slot when the board is pulled down to position and is released by hand when the board is to be pushed back into place.



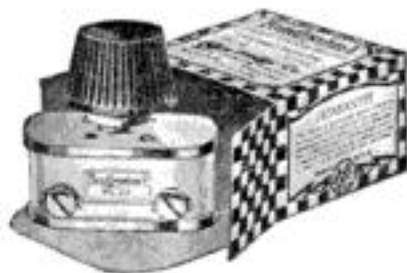
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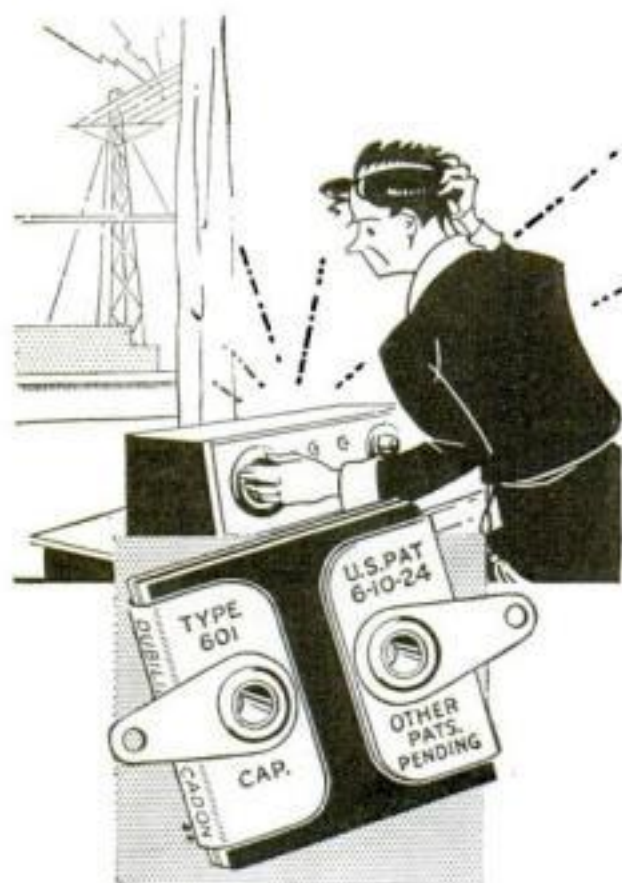
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## The Home Workshop

### "OLD IRONSIDES"

(Continued from page 67)



After the hull has been carried this far, it is ready to be painted and the deck varnished.

1882 she was made a receiving ship at Portsmouth, N. H. She was towed to Boston in 1897; in 1906-7 she received her third reconditioning.

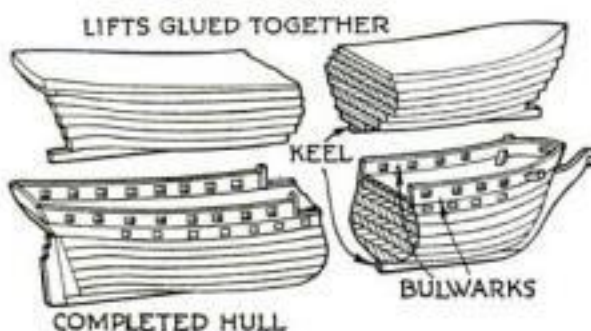
Her principal dimensions are: Length over all (hull), 204 ft.; beam, 43.5 ft.; depth of hold, 14.6 ft.; displacement, 2200 tons. Her speed was up to about 12½ knots, and her crew up to 500 men.

If the model here represented is carefully made, it will be, in its way, as beautiful as the original ship, presenting in its sturdy lines and heavy armament a sense of invincibility, and in the slender tracery of its lofty spars and ropes, the perfection of rigging that gave her speed.

In the fashioning of the model there are no insuperable difficulties, provided the instructions are followed part by part. Careful, nimble-fingered work will be needed, but that is always a joy to those so inclined. Though she may take a long time to make, she is worth it and will be ornamental in all stages of the construction.

The *Constitution* has been altered in minor details several times, which makes it difficult to state that she was thus-and-thus at such-and-such a time. It would not be fair to make her just as she is now, in her non-seagoing trim. Therefore, some of the early decorative features, as at the head, have been embodied.

On the whole, the model represents her, I believe, about as she was in the War of 1812. There is no certainty, however, that the deck plan given was adopted



After the lifts are glued together, the deck sheer is cut. The hull then is carved to its finished shape, and the keel, stem, sternpost, rudder, catheads and bulwarks are added.

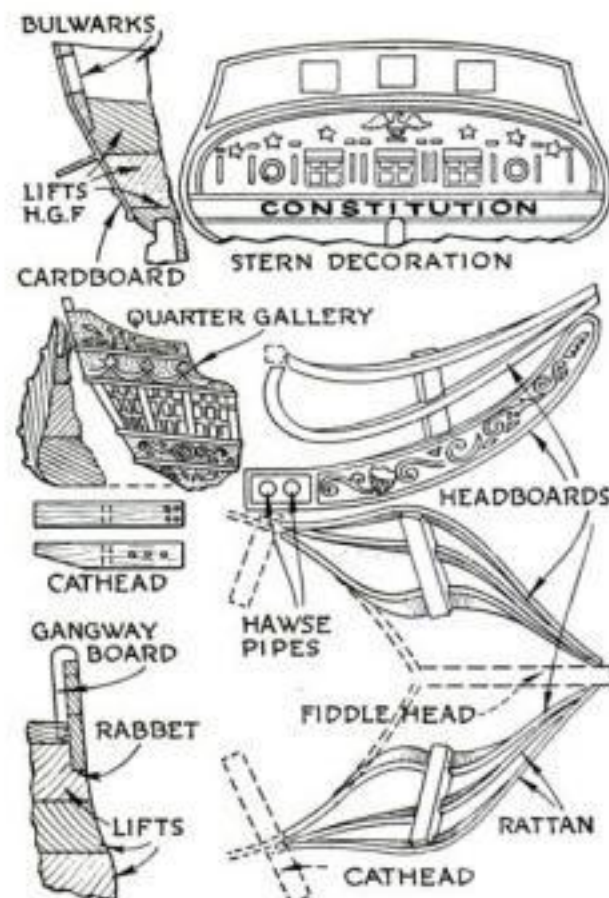
before 1907, and even in that there is no place indicated for the boats.

The plans given here for the model have been adapted and simplified directly from Government blueprints. The scale used is that of 1/10 in. on the model to 1 ft. on the real ship. This gives us a model of 18 in. on the load water line, and 31 in. long from the end of the flying jib boom to the

end of the spanker boom and 24 in. high from keel to main truck (the over-all dimensions). This is a sizable model for the average room. A larger model may be made, however, by enlarging all the plans given to the desired scale. A smaller model is not advised, if it is wished to keep to scale and embody all the details given.

The rigging has been slightly simplified and not all the details have been used, but the essential and characteristic features are all given.

As with all models, the first things necessary are full sized drawings of every part to be made. It is no easy task, however, even for skilled draftsmen, to lay out



Details of the stern and quarter gallery, the bent headboards, and method of setting the bulwark strips into a rabbet in the hull.

the curves accurately, and you can save yourself all the work of preparing full size drawings by sending 75 cents for Blueprints Nos. 57, 58 and 59 to the Blueprint Service Department, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York (see page 85). These sheets contain all the full size drawings you will need—hull, rigging and details. They will save you many hours of tedious work.

To make the hull, eight pieces of white pine will be needed. These will be from 16 to 19 in. long by 2½ to 4½ in. wide by 5/12 in. thick (½-in. stock, dressed). Draw a line right round the center of each lengthwise. Transfer from Blueprint No. 57, or from your own full size drawing, one of the lift plan lines A to H on each piece of wood, and also mark the constructional lines II to XI. Be careful that the center line of the plan corresponds in each instance with the line on the wood. This is best done by cutting the plan at the line or by first taking the lines off on tracing paper and scribing through carbon paper on to the wood.

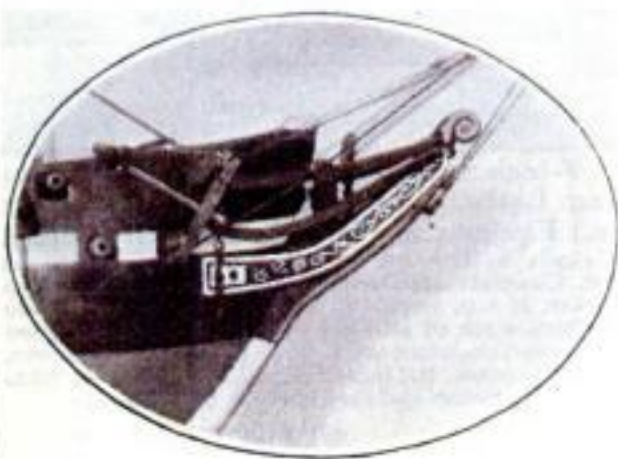
These pieces must now be cut out with a coping, fret (Continued on page 89)



## The Home Workshop

### "OLD IRONSIDES"

(Continued from page 88)



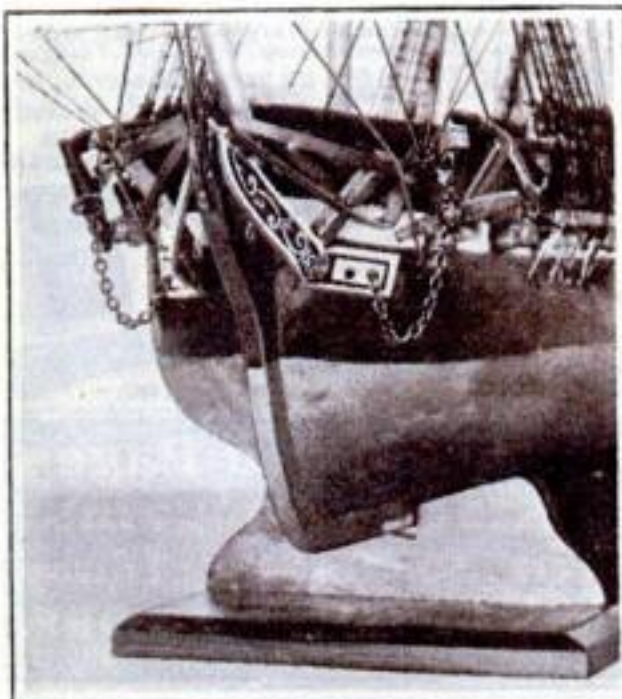
The decorated trail board and the head rails, which curve upward to meet the stem

or jig saw. Keep well outside the pencil lines so that the wood may be dressed up with sandpaper before joining. Continue the construction lines II to XI and the fore-and-aft lines around the edges and be careful to indicate on the edge of each lift which is the bow end.

It should be noted that with this ship the upper lifts are wider, because of the "tumble-home," on the lower edge than the upper, amidships, but like the lower ones are wider above than below at the ends. Therefore, the greatest width at any position has been given in the half-breadth plan. The idea of this may be seen in the body plan, but it will explain itself as you proceed; the main point is to leave sufficient stock everywhere for the subsequent shaping operations.

Parts B to G may have their centers cut out, to lighten the model, if you wish.

**N**OW glue all these lifts together. See that the construction lines at the sides and ends form continuous straight lines. Each part may be lightly nailed to the next as you build up, the nails being



Another view of the bow, which shows the graceful way in which the headboards are bent

on the inside with their heads well sunk, or the whole may be clamped together before gluing, and bored to take two dowels, which are inserted in the bottom piece so that

(Continued on page 90)

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## The Home Workshop

### "OLD IRONSIDES"

(Continued from page 89)



The hull from stern. The decorations are painted on cardboard and glued in place

the other lifts may be dropped on, as glued. The ends of the dowels must come under the hatches so that they will not show on the deck. Leave the lifts in clamps or under heavy weights for at least twelve hours to dry.

From the sheer plan transfer to the wood the dotted line that represents the deck; also mark the stem and stern profiles. Cut away the waste wood. Make the deck a smooth curve from stem to stern, slightly higher in the center than at the edges. On the deck mark the deck outline, which is the top edge of piece H.

On to thin cardboard mark the body plan lines I to XI and cut them out to form templates to fit on the outside of the hull during the shaping process. Now shave away the projecting corners of the lifts until you have smooth curves, vertically and horizontally, which correspond with the templates when held at their respective positions. A plane, chisel, gouge, spokeshave and half-round cabinet rasp or wood file are all useful for this, especially the latter two.

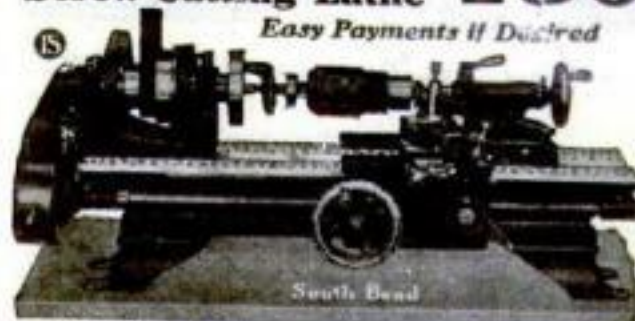
**BE CAREFUL** in shaping the hull. Work quickly, if you like, but not hastily. All the rest will be waste if your hull is not correct.

The keel is  $\frac{3}{8}$  by  $\frac{5}{8}$  by  $16\frac{1}{2}$  in. and extends under the stem and sternpost. It is glued and nailed on. The stem and sternpost, which are of the same thickness, are cut from the sheer plan to shape and fastened similarly. See that the ends of the hull itself run neatly to them.

Scratch in the water line, which, it will be noted, is not parallel with the keel. Mark in also the lower edge of the main deck gun ports and their vertical edges with reference to the ports which are to come above them. In the center of each square thus formed, bore a  $\frac{3}{8}$ -in. hole  $\frac{1}{4}$  in. deep carefully at right angles to the ship's side and slightly down from the horizontal (so that the guns will point very slightly up). The aftermost ports are dummies and have windows painted on instead of guns. (Continued on page 91)

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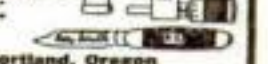
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## The Home Workshop

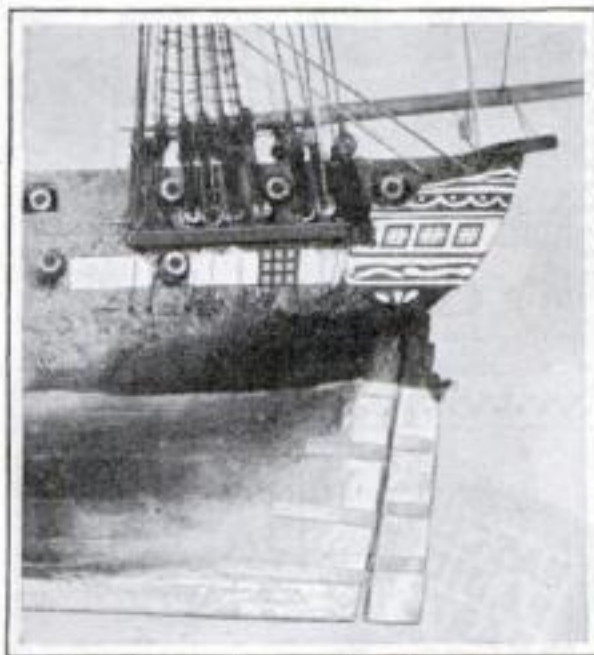
### "OLD IRONSIDES"

(Continued from page 90)

Right around the top edge cut a rabbet (recess)  $\frac{1}{4}$  in. down and  $\frac{1}{8}$  in. deep into the hull. From white pine make two pieces a full  $\frac{1}{8}$  in. thick,  $1\frac{1}{4}$  in. wide and 20 in. long. Shape the lower edge to the deck line and cut out the gun ports after marking them from the sheer plan. The top edges of these pieces should really be but a bare  $\frac{1}{8}$  in. thick, but it is safer to make them a little thicker.

Now glue and nail these pieces in the rabbet after the bow ends have been steamed to make them bend easily. The two edges should be cut to fit together neatly at the bow. They may need strengthening with a small block or elbow, to keep them together; it can be seen in the deck plan.

Cut the stern bulwark and fasten that on similarly with neat joints at the corners. Now shave the top of the bulwarks until you get the lines as shown on the plan, and cut away the gangways, so that



Stern view showing cardboard strips glued on to represent the pintles and gudgeons

the bulwarks there stand up only a bare  $\frac{1}{8}$  in. above the decks.

Make the gangway boards of hardwood. Sink the lower ends into the deck and nail them to the edges of the bulwarks (as shown on page 88).

The rudder may be seen above and in the sheer plan; it extends into the hull under the transom and can be fastened with double-pointed nails. The plates for the pintles and gudgeons (hinges) may be simulated with cardboard strips, glued on.

**T**HE catheads, which come next, are of any reasonably tough wood, about  $\frac{3}{8}$  in. square by  $1\frac{1}{4}$  in. long. Each projects through a hole in the bulwark. The outer end has three holes fore-and-aft for the boom guys and four vertical holes at the end for the cat fall; the inner end is beveled to lie flat on the deck, to which it is glued and nailed. Note in the sheer plan how the cathead slants forward and upward.

Bore a  $\frac{1}{4}$ -in. hole for the bowsprit, a  $\frac{1}{8}$ -in. hole

(Continued on page 92)

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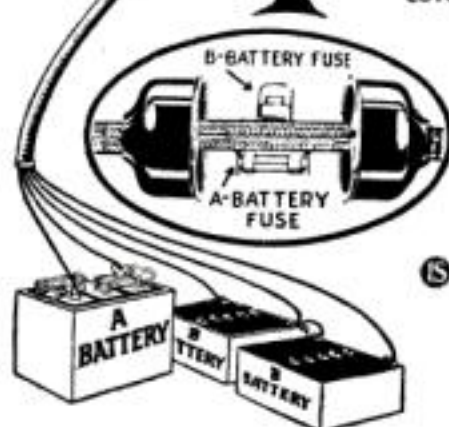
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## The Home Workshop

### "OLD IRONSIDES"

(Continued from page 91)

through the cutwater for the gammoning lashing, and two small holes for the bob-stays, as in the sheer plan.

The headboards may be made next. The wide lower members, which carry the painted scrollwork and lead up to the fiddle head, are thin pieces of waterproof three-ply wood (or a solid piece of soft wood)  $3\frac{3}{8}$  in. long; they will require to be steamed until quite soft. The first  $\frac{1}{8}$  in. is firmly glued and nailed under the gun port streak; the remainder is bent out sharply and the upper ends are glued and nailed through to the stem just under the curl. The narrower members are, for preference, pieces of flat rattan (cane), glued and nailed under the catheads and to the cutwater.

The headboards are strengthened with a piece of wood placed inside of each half-way along its length; this may be notched to fit over the headboard members so as to form lapped joints. Two shallow  $\frac{1}{8}$ -in. holes are bored through the lower ends of the headboards into the hull for the hawse pipes.

The stern decoration had better be painted on a thin piece of black cardboard and glued on. The eagle is gold, with a red, white and blue shield; the other ornamentation, the name and the moldings are white. Before being painted, the moldings and decorations may be raised with gesso, which is a mixture of glue and whiting with a little varnish and linseed oil. It also can be obtained ready to use.

**T**HE stern windows may be cut out of the cardboard on three sides only and the flaps lifted to form shutters.

The quarter galleries are pieces of soft wood, cut to the shape shown on page 88 and glued on so that their after edges are level with the stern of the hull. They have windows and scrollwork painted on them. The windows may be painted blue and white on tin foil or thin celluloid.

That completes the building of the hull. The deck should be given two thin coats of clear spar varnish, and the outside of the hull two coats of flat white paint, each coat rubbed with fine sandpaper. The hull then can be given two coats of copper-bronze paint up to the water line and two coats of black above, except on the gun port line, which is white between the ports and right up to the stem. The inside of the bulwarks and the edges of the upper (frigate) deck gun ports are white.

**A** ROUGH cradle to stand the model in while working on it will be necessary. The uprights, which may be nailed to a board, should fit the sides of the hull loosely and be lined with a piece of felt or cloth. If a hole is bored in the center of the board in which to fit a peg on another board, a turntable may be formed whenever desired to make it easy to work on alternate sides of the model without having to pick it up or walk around it.

This work will keep you busy until next month, when the deck fittings and spars will be described.

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## A 2c Stamp

—will start you on the road to success. See Money Making Opportunities on pages 114 to 142.



## The Home Workshop

### Hanging Bookracks

(Continued from page 76)

shelves should be made  $\frac{3}{8}$  in. wider than indicated.

The bookrack illustrated in Fig. 3 is similar to the one just described, except that it is fitted with drawers between the two lower shelves instead of doors. The construction of the drawers is clearly shown in the detail.

Figure 4 shows a knockdown bookrack. This type is convenient because it can be taken apart and packed so that it takes up very little room. It is made so that it can either hang on a wall or stand on a table.

The sides and shelves are first planed to dimensions, after which the mortises and tenons connecting the upper and lower shelves with the sides are laid out. This must be done very carefully to insure a workmanlike job. It is best to gage lines with a marking gage from the front edges only of shelves and sides. Set the gage to 1 in. and mark all lines corresponding to that dimension, then set it to  $2\frac{1}{2}$  in. and gage again from the front edges; then to  $4\frac{1}{2}$  in., and finally to 6 in.

Bore the through mortises with a  $\frac{3}{4}$ -

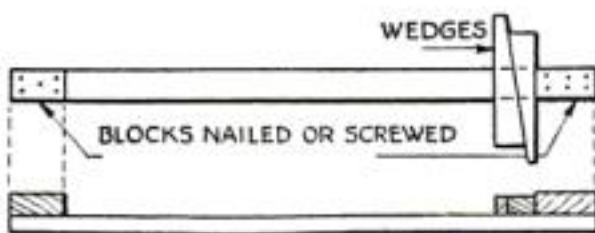


Fig. 5. Homemade gluing clamps for use when large iron clamps are not available

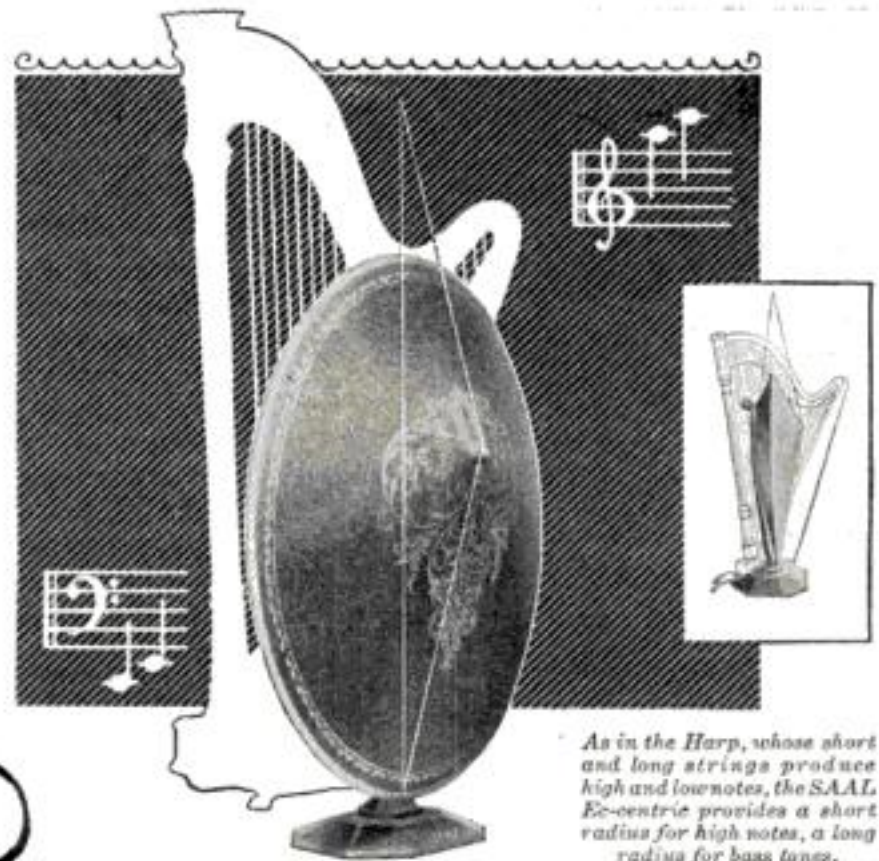
in. auger bit and square and clean the hole with a chisel, using it from both sides so as not to chip the edges. The tenons are sawed with a back saw and the waste pieces between them are chiseled away. After they are fitted the holes are laid out for the keys. Remember that these holes must be chiseled in such a way that the keys will always bear against the sides when driven home, thus forcing the joints together.

A dado is cut for the middle shelf, but it is stopped at both edges, so that the shelf will not be able to slide out. A small strip of wood  $\frac{1}{4}$  by 1 in. is glued to each shelf as a stop for the books, if the rack is to be used standing.

Iron or heavy brass plates of the same width as the thickness of the sides and about 3 in. long are screwed to the back of the sides, and the bookracks are hung from them.

The kind of lumber to be used and how it is to be finished should be dependent on the other furnishings of the room in which the bookrack is to be placed.

This is the first of a series of articles by Mr. Hjorth, who is an authority on furniture construction. He is the author of "Reproduction of Antique Furniture"; he was formerly Director of Technical Work in the Roman Baldorioty de Castro Technical School, San Juan, Porto Rico, and is now in charge of the Architectural Laboratory at Saunders Trade School, Yonkers, N. Y.



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The Saal Ec-centric comes in two models: 20-inch, \$25; 14-inch Junior, \$15. Slightly more west of Rockies.

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# SAAL



## How Many Laps to Go?

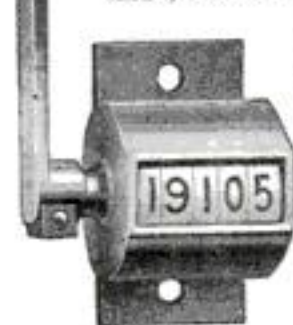
Have you any machines a few laps *behind* in the race for speedier, cheaper production?

Let Veeder Counters measure their gait; indicate their proper stride; aid in developing faster work by keeping track of the *gains*.

Set the pace, watch the count and run your machines for production-**RECORDS** on

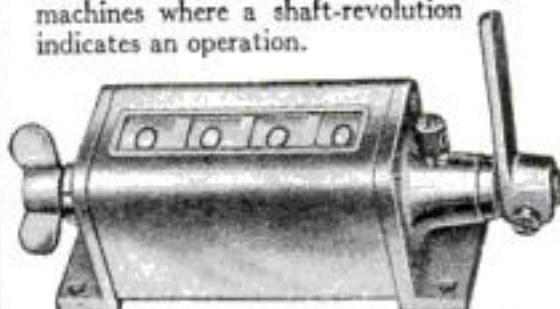
## Veeder COUNTERS

The small Revolution Counter below registers one for a revolution of a shaft, recording a machine operation, or product. Though small, this counter is very durable;



its mechanism will stand a very high rate of speed, making it especially suitable for light, fast-running machines and most adaptable to experimental work. If run backward the counter subtracts. Price \$2.00. (Cut 4/5 size.) Small Rotary Ratchet Counter, to register reciprocating movements of small machines, also \$2.00.

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*The Veeder booklet shows instruments that "count everything on earth." See them—by sending for the book.*

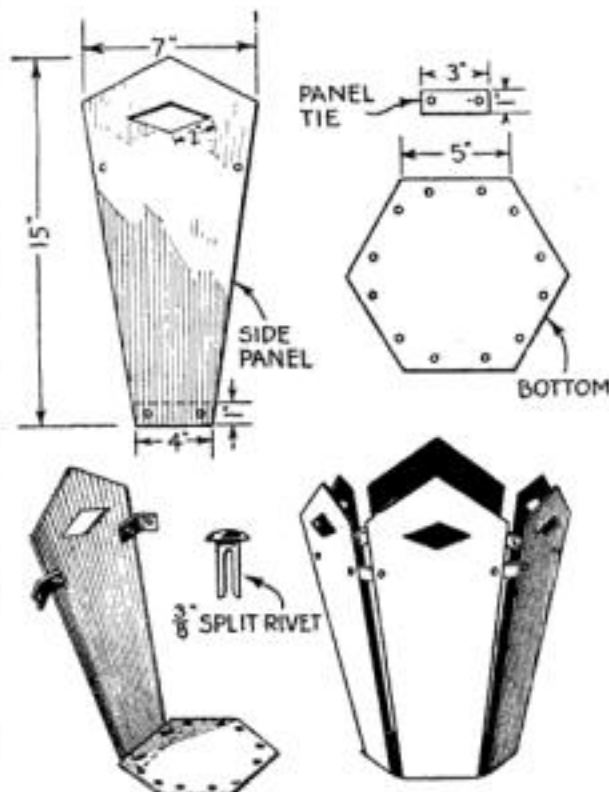
**The Veeder Mfg. Co.**  
44. Sargeant St. Hartford, Conn.

## The Home Workshop

### Neat Waste Paper Basket Made of Wallboard

**W**ALLBOARD or very heavy cardboard such as is used for large shipping cartons may be converted with very little effort into useful articles, such as the waste paper basket illustrated.

Six side panels are required and six small pieces to tie the panels together. The bottom is cut from a circular piece of the same material 10 in. in diameter. The circle is divided into six equal sides with the compass without changing its



How the side panels and bottom are cut out and fastened together with split rivets

setting. Simply "walk" around the circle with the legs of the compass and connect the points with straight ruled lines.

The bottom of each panel should be bent at right angles, as indicated by the dotted line. Holes for the rivets should be punched with a leather punch.

The parts then are assembled with brass rivets about  $\frac{3}{8}$  in. long. The side panels are all riveted to the bottom first and then the ties are placed about 3 in. down from the top.

The panels can be cut out in almost any desired style and the open work ornament can also be made in a variety of designs.—HAROLD JACKSON.

### Common Brick Serves As Wick in Furnace Vapor Pan

**I**F THE design of the vapor pan in a hot air or "pipeless" furnace will permit, place a common porous building brick in the water container so that it stands upright inside the furnace jacket. There may not be sufficient room for the brick to stand straight; then it can be tilted at an angle toward the furnace, and, indeed, it seems to furnish more moisture in that position than when perfectly upright. The brick acts as a wick. My experience has been that its use results in nearly twice as much water as usual being evaporated, provided the water pan is filled every day.—S. PARKINSON.



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## The Home Workshop

### How I Earned the Cost of a New Water Heater

By THOMAS W. BENSON

IN MANY old houses the coal stove is being removed from the kitchen and a radiator installed to heat the room. The problem of furnishing hot water is then solved by installing a tank and heater in the basement.

Because of this change, it often happens that the house owner has on hand a good horizontal water boiler from the old range, but has to discard it and buy an upright tank. It is not practical to use these tanks in a horizontal position when a gas water heater is employed, because practically the entire tank must be heated before hot water can be drawn from the faucets. Where a laundry stove or a coil in the regular house heater is used, the tank may be mounted horizontally and will work satisfactorily.

The writer, who was confronted with these problems, devised a system of piping the horizontal boiler so it could be used vertically. This makes it possible to use a gas water heater during the months when the furnace is out.

The method of piping the tank is shown in the illustration. The four outlets to the tank are shown in a row merely for the sake of convenience and clearness.

The holes in the tank were already tapped for  $\frac{3}{4}$ -in. pipe. The discharge from the heating coil was continued up to within 6 in. of the top of the tank by a  $\frac{1}{2}$ -in. pipe tapped into the end of a  $\frac{3}{4}$ -in. pipe, which was screwed into the head of the tank. Likewise, the pipe leading to the hot water lines was continued to within 2 in. of the top of the tank. The other outlets were piped as shown.

A GAS heater is employed in summer, while a single-turn coil in the house furnace serves the same purpose in winter.

It would appear that the hot water, having to flow down through the body of cold water, would be unduly chilled, but the chilling is slight because the water around the outlet pipe warms up and, as it rises, warms the area around the pipe.

Occasionally air collects in the top of the tank and is discharged with a sputter at the faucets when it collects in such amounts as to reach the discharge pipe, but otherwise the plan is not objectionable. In fact, the presence of the air acts to absorb partially the water hammer caused when faucets are suddenly closed.

"I HAVE built five Barbary pirate ship models and one Spanish galleon from your blueprints. It can be truthfully said that these plans are the most complete of any."  
—G. A. P., Jackson, O.

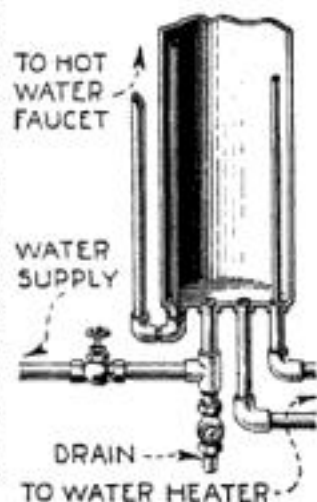


Diagram showing how the tank was piped

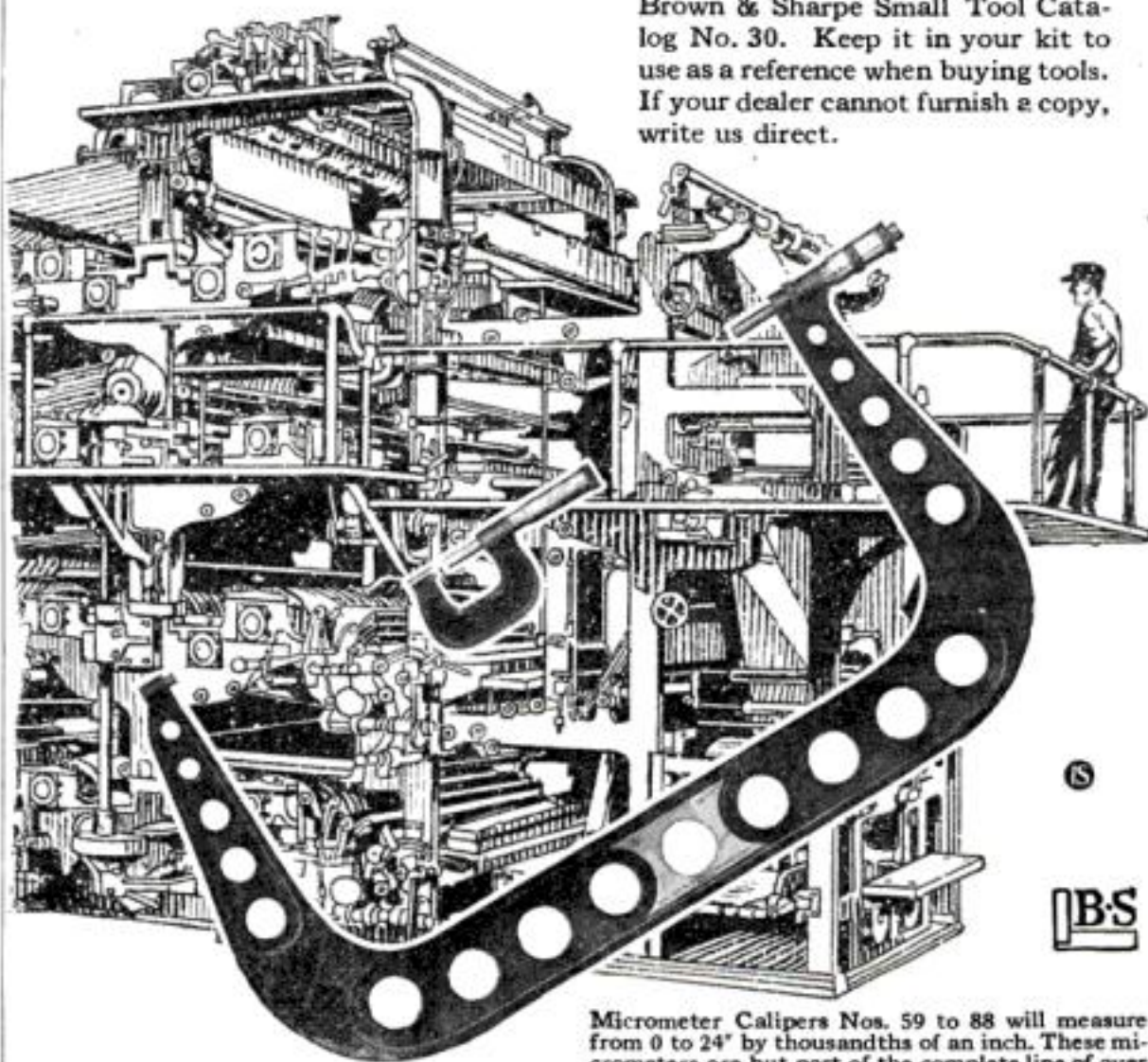


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## The Home Workshop

### Decorative Book Trough with Candlesticks

DECIDEDLY novel and artistic is the book trough illustrated, yet it is of simple construction. A figured hardwood may be used if the piece is to be varnished, or a plainer wood if polychromed.

The trough itself is made of two pieces  $\frac{3}{8}$  by  $5\frac{1}{2}$  by  $12\frac{3}{4}$  in. Make notches in the upper corners  $\frac{3}{8}$  by 1 in. and round off the shoulders to a radius of  $\frac{3}{4}$  in. Then miter the lower edges, as shown in the detail.

Before marking the end pieces, rule a 5 by 8 in. piece of cardboard into  $\frac{1}{2}$ -in. squares and copy the outline for half the design. Cut this out and trace it on 1-in. stock, reversing the pattern to mark the other half. Shape the piece with compass and coping saws and smooth the edges carefully with a wood rasp and sandpaper.

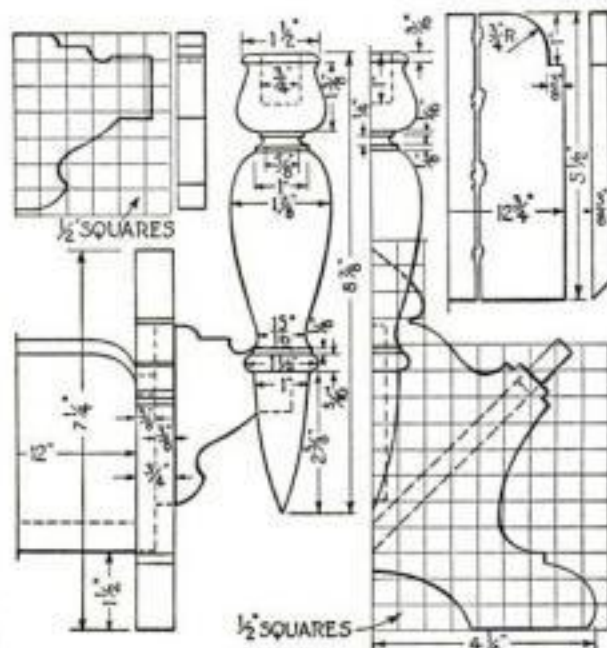
Notice that the ends of the trough are housed into the end pieces  $\frac{3}{8}$  in. deep. The mortises can be laid out from the pattern. Hollow them by cutting across the grain with a narrow chisel and work carefully to avoid bruising the corners. Also cut mortises centering on the outside  $\frac{1}{2}$  in. by  $3\frac{3}{8}$  in. and  $\frac{3}{8}$  in. deep to receive the brackets.

The pattern for the brackets is made in the same manner as for the ends, on cardboard 3 by  $3\frac{1}{2}$  in. When shaped, glue the brackets into the ends and assemble the ends and the trough.

The candlesticks are  $8\frac{7}{8}$  in. long and  $1\frac{7}{8}$  in. in diameter at the thickest



A very attractive piece for the reading table



Working drawings of book trough and details of the trough sides and candlestick brackets

point. Bore the sockets 1 in. deep with a  $\frac{3}{4}$ -in. bit. Mortise each stick  $\frac{5}{8}$  in. deep to receive the bracket ends.

If no lathe is available, the candlesticks can be sawed out four-sided, following the same profile. Finish with stain, filler, and varnish or with opaque colors. —EDWIN M. LOVE.



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Hair is Healthy Hair"

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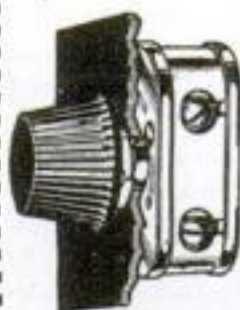


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## Home Workshop Chemistry

Simple Formulas that  
Will Save Time  
and Money

**PRECIPITATED** chalk is a white and very light powder, which can be obtained at any drug store. It is one of the preparations of chalk, the commonest and most familiar of which is sold under the name of whiting at all paint stores.

Whiting is very cheap and its most common use is in putty used for glazing and filling nail holes and cracks.

In the home workshop the main value of precipitated chalk (or whiting) lies in the ability it has to unite with other substances to form putty and cement. It is less frequently used for preparing cleaning powders.

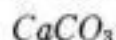
As a putty it is used for fastening window panes, assembling aquariums, and cementing joints in gas and water pipes. A putty for this purpose must never dry to such an extent that it will be shattered easily by vibration. The chalk, therefore, should be mixed to a soft paste with raw linseed oil, which dries much more slowly than the boiled variety. The tendency is to mix the putty too stiff. Indeed, it often pays to add raw linseed oil to prepared commercial putty.

When putty is to be used for an aquarium or for the tightening of piping, at least fifty percent of red lead is added to the whiting. Enough raw linseed oil should be added to make a soft paste.

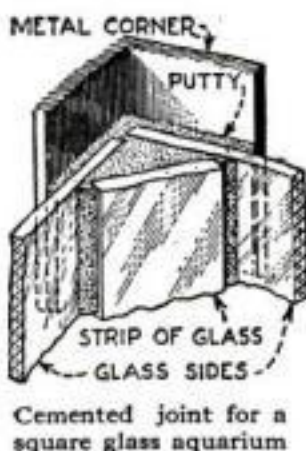
Place plenty of this putty around the edges of the glass and force it firmly into the frame. Remove the surplus with a knife. Next cover the inside edges thickly with putty and protect these edges later with narrow strips of glass, as shown, so that almost no surface is exposed to the water. This tends to seal the putty from the air and water and helps to keep it soft. Incidentally, keep water in any aquarium for at least one week before stocking it with fish.

You will always have this information about chalk available if you will cut out the following label and paste it on the container or file it away among your formulas:

### Calcium Carbonate



**PRECIPITATED** chalk (or whiting) is useful for making cements of various kinds. Mixed with water glass, it forms a cement for porcelain and glass. Mixed with raw linseed oil, it forms a putty for windows. When at least fifty percent of red lead is added to this putty and the entire mass made quite soft with the addition of raw linseed oil, the cement formed can be used for making pipes air-, water-, and gas-tight; it is also well adapted for puttying glass in aquariums.



# 30 Days Trial



1 Dial  
5 Tube  
**\$57.00**  
RETAIL PRICE

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2 Dial  
5 Tube  
**\$47.00**  
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## Hewing to the line is easy with this chisel-edge claw Hammer

HERE is something new in hammers. The one-pound head of forged steel carefully tempered has a chisel-edge on the end of the claws. It is perfectly balanced and the two extra side claws makes it possible to pull nails in close corners or next to the wall.

The distinct curve to the claws creates a fulcrum that makes it possible to pull out large nails with one pull.

The chisel-edge claw hammer has been tested and approved by the Popular Science Institute of Standards.

Every man doing carpentry work or odd jobs around the house will find hundreds of uses for the three-in-one hammer. It will do everything any other hammer will do. Besides it can be used as a chisel and it will get at nails that other hammers won't reach. The price for this new hammer is only \$2.00.

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# CHISEL-EDGE CLAW HAMMER



## The Shipshape Home

### How to Replace Sash Cords

IT IS surprising how many persons have little or no practical knowledge of the mechanism that balances the ordinary double-hung windows which they pull up and down every day. Consequently, when a sash cord breaks and the window fails to operate, they have to pay for the expensive services of a mechanic to do a job that can be done very easily by any home owner, whether man or woman. All



Fig. 1. The window stop is pried off

the tools needed for the task of replacing the cord are a chisel, a hammer, and perhaps a screw driver.

A length of the best quality sash cord should be obtained before the job is begun. As a safe measure for length, without having the old cord as a guide, use the distance from the window sill to the pulley, plus 8 in. Sash cord can be bought at any hardware store, and no substitute should be used. With the

cord ready for use, proceed with the work as follows:

Pry off the window stop with a chisel, as shown in Fig. 1. This needs to be done only on the side where the broken cord is. If the cords should be in need of repair on both sides, *(Continued on page 99)*



Fig. 2. The cord is removed by easing it out of its groove with a screw driver

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**\$25 IN PRIZES**  
See Cash Prize Offer on Page 114



## The Shipshape Home

### Replacing Sash Cord

(Continued from page 98)



Fig. 3. Removing the parting strip



Fig. 4. How the "pocket" appears

it may be necessary eventually to remove both stops, depending upon whether the stop covers the "pocket" piece, which can be seen in Fig. 4.

Next, pull the sash out at the side where the stop has been removed and slide it out of its groove at the opposite side. It is well to remember at this point that glass is now being handled. Do not make any abrupt or violent movements that might add the job of reglazing to the one already at hand.

The cord which is not broken must be removed. This is done with the aid of a screw driver or other sharp instrument as shown in Fig. 2; just pry the cord out of its groove. Sometimes it will be found that a shingle nail has been driven into the knot. This makes it somewhat harder to loosen. Tie a large loop knot on the cord before releasing it so that the weight will hang suspended in the frame with this knot against the pulley.

If the upper sash is the one needing attention, the "parting strip" must next be removed. That is the strip or stop against which the outside of the lower sash and the inside of the upper sash slide up and down. Sometimes this strip is tightly stuck in the paint and must be cut loose with a chisel or other edge tool as shown in Fig. 5. If this is not done it will tear the wood when it is forced out of its groove. (Continued on page 100)



Fig. 5. If the parting strip is stuck in its groove with paint, loosen it with a chisel



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Aristocrat E-Z TOON Vernier Pointer



\$2<sup>00</sup>

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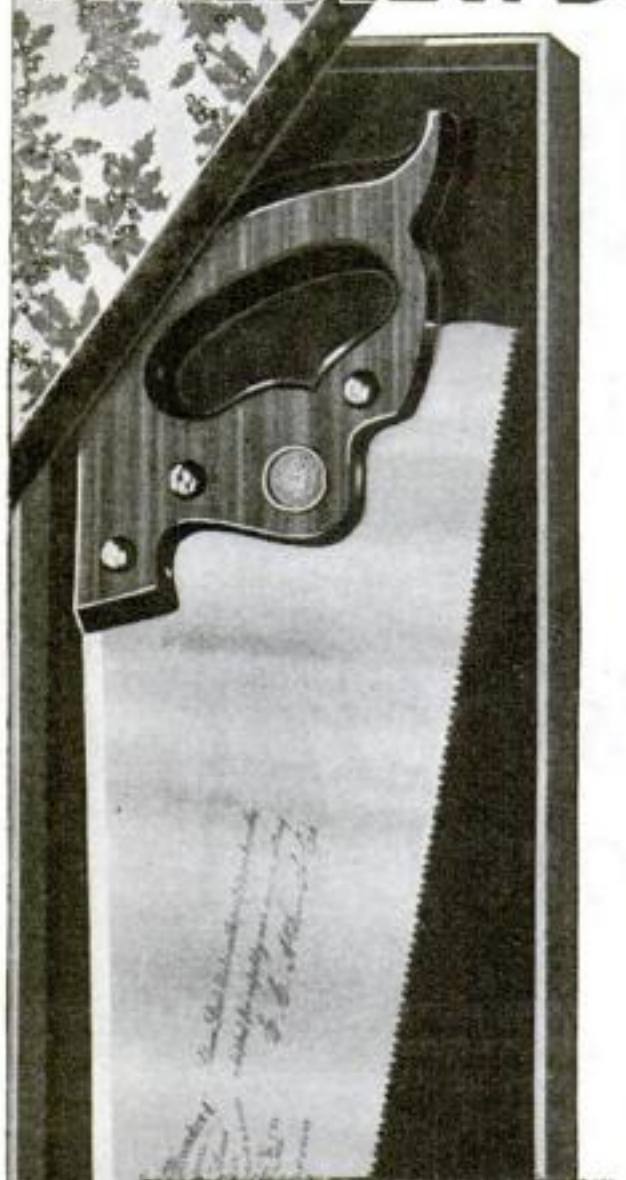
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## The Shipshape Home

### Replacing Sash Cord

(Continued from page 99)

After the paint is cut, the strip is pried out carefully. When doing this set the chisel firmly in the wood (Fig. 3) and do not let it slip. Pull the upper sash down to the sill and loosen the strip from the top downward. Then lift the strip up to make it clear the "meeting" or lower rail of the upper sash. Now the sash itself may be removed by loosening the cords on each side as directed for the lower sash.

The "pocket" piece (Fig. 4) is pried out after the one or two screws which hold it in place have been removed. This piece is sometimes located in front of the parting strip and partly under the



Fig. 6. Tying the sash weight. A knot must be used that will never slip or loosen

window stop. If it is located as shown here, however, the parting strip must be removed regardless of whether the lower sash only needs attention, since the pocket cannot be opened otherwise.

Inside in the opening thus revealed will be found the released sash weight—an iron casting.

Now tie a knot on one end of the new cord, similar to the one found inserted in the edge of the window, and secure this knot in its proper place. Nail it if a nail was used in the old cord.

Put the window back in the frame and insert the free end of the cord in the open pulley. Push the window to the extreme top and if it will not stay there, fasten it with a wedge or have someone hold it. The loose end of the cord will probably be easy to find at the open pocket. If you cannot get the end of the cord in this way, pull it out entirely and make what is called a carpenter's "mouse," which is simply a piece of soft lead, chain or other small weight tied to the end of a string. Slip the weight over the pulley, tie the string on the end of the sash cord and pull the cord through.

Stand the weight on the window sill and while it is in that position, tie the cord taut as

(Continued on page 101)

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## The Shipshape Home

### Replacing Sash Cord

(Continued from page 100)

shown in Fig. 6. This will leave the cord the correct length. Study the old knots for the type that will not slip.

All carpenters, of course, do not follow exactly the same method in doing a job of this kind, but the process as outlined is a good one for the beginner to follow.

The process of assembling the window is simply a reverse of the one already used. Take care not to drive long nails where they will interfere with the action of the weights. Care also should be exercised in nailing the window stop back in position. It is well to put nails in all the old holes just as a matter of covering the holes even if a few new ones must be used to add the needed strength.

It is not amiss at this time to examine the other cords to see if they are worn enough to require attention and thus save the trouble of having to do the job over again soon.—EMANUEL E. ERICSON.

## PAINT TROUBLES— Their Causes and Cures

By BERTON ELLIOT

MRS. ANDREWS, our neighbor, dropped in the other evening.

"I've been saving these for you," she cooed sweetly but with a roguish twinkle in her eye, as she unrolled a strip of paper that seemed about a yard long. "They're troubles!"

"Troubles?" I repeated.

"Yes. I've been doing quite a bit of painting about the house lately, going ahead of my own accord without asking any questions of anybody, and there have been things that didn't turn out right."

"Well, let's hear about them."

"I was doing one of the bedroom floors with varnish stain, and it didn't work well at all. At other times it had been just as easy to use as anything, but this time it pulled and dragged under the brush. I thought I would never get through. And, besides, it didn't look very well either. The color wasn't nice and even. A big batch of color would stick in one place, and I would keep brushing away to spread it out evenly, but it wouldn't spread very well. When I got through the floor was streaked—dark in some places and light in others."

"A little turpentine was all that was needed," I answered. "Some of the liquids had evaporated since the last time you used the varnish stain. If you ever have any varnish stain that works that way again, just add some turpentine and stir it in well, and you will find your varnish stain working 'as smooth as butter' under a brush again."

Her next question had to do with the use of varnish (Continued on page 102)



## Pathfinders

An advertisement of  
the American Telephone and Telegraph Company



CHRISTOPHER COLUMBUS discovered America, thus adding a new world to the old. Alexander Graham Bell discovered the telephone, giving the nations of the earth a new means of communication. Each ventured into the unknown and blazed the way for those who came after him.

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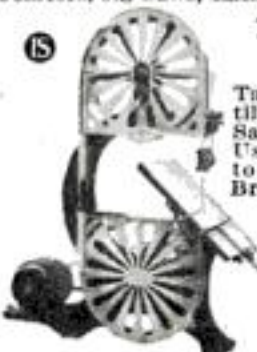
Its continued advancement requires constant effort in working upon a never-ending succession of seemingly unsolvable problems.

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of this issue

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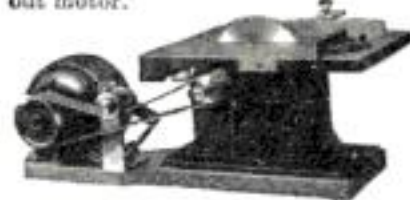


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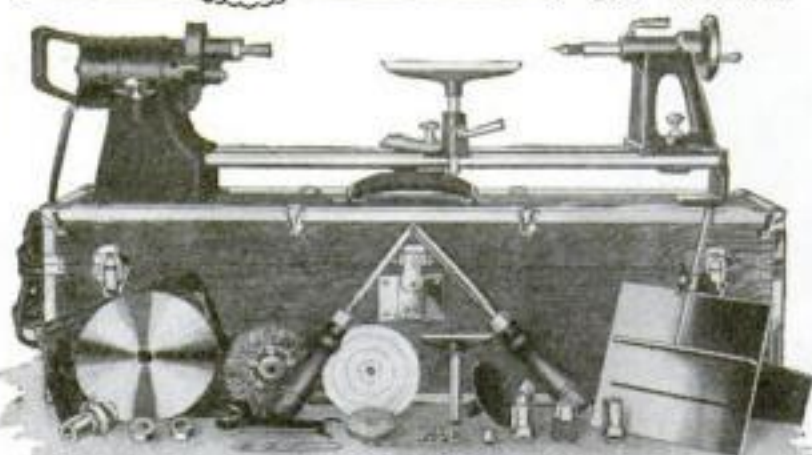
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## The Shipshape Home

### Painting Troubles

(Continued from page 101)



The way to wash off the last traces of  
paint remover is with gasoline and scrub-  
bing brush, as Mr. Elliot recommends

stain on the stairway and landing and the woodwork of the downstairs hall. The varnish was from a new can and went on satisfactorily. It looked fine but didn't dry for about two weeks.

"We had an awful time getting up and down stairs," she added, "and spoiled the finish in a few places where we had rigged up boards to step on."

A number of questions on my part failed to furnish any clue, but a casual remark revealed what the trouble was—a mistake countless amateur painters make. It seemed that Mrs. Andrews, in her desire to do an especially good job, had taken off the old finish with a paint and varnish remover.

"I THINK we have your trouble," I interrupted. "When you got through using the paint and varnish remover, did you wash up the surface with gasoline?"

"No-o-o!" responded Mrs. Andrews slowly. "I remember now the directions did say to wash up thoroughly with a liberal amount of gasoline, but when we got through using the paint remover we had forgotten this. We wiped up the woodwork with a cloth, though, and it looked nice and clean."

I explained that a paint and varnish remover gets into the surface, and it takes gasoline, benzine, or turpentine to cut the remover and wash it out. The best way is to take plenty of gasoline and use a scrubbing brush.

"What's next?" I inquired.

"I am just doing the walls in that new room we finished up in the attic. I filled the cracks and imperfections with plaster of Paris and paint, after the first coat of wall paint. When I put on the second coat these spots all showed through much lighter in color. Why was this, and will the next coat cover them up?"

"That was probably due to one of two things. You may have put on the second coat too soon after filling the cracks and before the plaster of Paris mixture had a chance to harden clear through, so that these spots

(Continued on page 103)



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## The Shipshape Home

### Painting Troubles

(Continued from page 102)

absorbed the paint much more than the rest of the wall. Or else you may have mixed the plaster of Paris with wall paint just as it came from the can, instead of using some of the 'fifty-fifty' mixture of wall paint and wall size which you used for the first coat on the walls. If the crack filling mixture was made without any size, it would tend to be porous and absorbent. Seal over these spots in some way; otherwise the next coat also will sink in and the spots will still show through. One of the best ways to do this is with a thin coat of shellac. Shellac dries in an hour or so, so you won't lose any time."

"HERE'S another one," our visitor went on, after making a note about the use of shellac. "It wasn't due to anything going wrong in the work, but a little hard luck afterwards. You know the kitchen we fixed up so prettily? Well one of the kiddies left the water running in the bathroom; it overflowed, and came down through the ceiling. That's all speckled with dozens of blisters puffed out as big as hen's eggs. It looks ter-ri-b-l-e."

"That certainly was tough," I commiserated. "Well, as long as it's only the ceiling that is spoiled, it won't take so long to fix it up. First, break all the blisters with a putty knife and scrape off all the loose paint—away back as far as the paint is the least bit loose. Then go over all these spots with a thin coat of shellac, being careful not to miss any. Make a mixture of plaster of Paris and equal parts of wall paint and size, using the same color wall paint as was previously used on the ceiling. Make this mixture reasonably thick and knife it on to the spots with your putty knife, smoothing it out nicely to fill up the depressions in the paint film, and make them even with the painted surface. Allow twenty-four hours for drying and then give the entire surface a brush coat of wall paint of the proper color into which some wall size has been added in the proportion of about two parts paint to one part size. Allow twenty-four hours for this coat to dry, or, preferably, forty-eight hours if you are in no particular hurry. Then apply another coat of wall paint as it comes in the can, and you'll have a new finish just as good as the old one."

That's all the ground we covered that evening, but Mrs. Andrews promised to bring us more "troubles" if she encountered them. And she is very apt to, because there is more to painting than the amateur ever realizes.

This is the first of a series of articles in which Mr. Elliot answers the questions that so often perplex those interested in home painting and decorating.

DISCARDED auto fenders and body panels, obtained from junk dealers, are inexpensive material for making letter boxes and containers of various kinds. With a little care the original enamel finish can be retained.—G.D.H.



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Making bursted water jackets and pumps good as new, stopping leaks in radiator, hose connections, gas tank and gas, oil and exhaust lines, making a fume-proof joint between exhaust pipe and tonneau heater, tightening loose headlight posts, keeping grease cups, hub caps and nuts from loosening and falling off, etc.

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## Better Shop Methods

### Old Bill Inspects a Lathe and Aids a Machinist

By JAMES ELLIS

**O**LD BILL still felt a boyish thrill about being in another city. He had come a hundred miles to look at several machines that were for sale.

Finishing his breakfast, he taxied out to the shop where he was to inspect one of the machines. He was a bit too early for the proprietor, so, from force of habit, he ambled into the shop.

"Look who's here! Glad to see you!"

Old Bill winced a little from an exuberant greeting emphasized by a vigorous slap on his shoulders, but a smile spread over his face as he recognized in the foreman of the shop a man who had worked for him several years before. Old Bill looked about the place. He sensed that the younger man's eyes were following his,



as though anxiously awaiting Old Bill's verdict.

"I am glad to see that you keep your place clean," Old Bill commented approvingly.

They chatted of old times awhile until the proprietor arrived and led the way to the lathe that was for sale.

Old Bill went up for a close examination. It did not take any time for him to note scars and scratches on the ways, and barely a touch sufficed to tell him that the cross feed screw was pretty loose. The tailstock spindle could be clamped, so it was not worn much, and there were no missing teeth on the headstock gears.

Starting the lathe at a pretty good speed, he listened to the quick change gears. They did not seem bad.

Then he looked to the spindle bearings. He found a board close by; using it as a lever under the faceplate, he tried to raise the spindle out of the bearings. Any looseness would have been felt at the end of the board.

One thing more interested him. He rubbed his finger over the vees, then studied them closely. Just as he had thought, the lathe had done a lot of hard work in its time. (Continued on page 105)



### World Radio Storage "B" Battery

12 Cell—24 Volt

Proved value. Thousands of users find reception almost magical. Clear, true power—instantly and unendingly. Wise economy. Sturdy construction—Solid Rubber Case protection. Recharged for almost nothing. Endorsed and listed as standard by famous Radio institutions including Pop. Radio Laboratories, Pop. Sci. Inst. Standards, Radio News Lab., Lefax, Inc., and other Radio authorities. What more need be said? Extra Offer: 4 Batteries in series (96 volts) \$10.50.

**Send No Money** Just state number wanted and we will ship same day order is received, by express C. O. D. Pay expressman after examining batteries. 5% discount for cash with order. Remember—you save 50% on World Batteries.

### WORLD BATTERY COMPANY

1219 So. Wabash Ave. Dept. 80 Chicago, Ill.

Makers of the Famous World Radio "A" Storage Battery  
Prices: 6-volt, 100 Amp. \$10.00; 120 Amp. \$11.00; 140 Amp. \$12.00.  
All equipped with Solid Rubber Case.

Set your radio dial at 288.3 meters for the World Storage Battery Station WSBG, Variety New Talent—Always Interesting.  
JERRY SULLIVAN—Director and Announcer—"Chi-CAW-go"

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Engine**



150,000 in daily world wide use. 1½ to 30 Horse Power.

DIRECT From Factory—Wholesale Prices—Easy Terms—No Interest. 57 years proves WITTE most durable, economical engine made—burns almost any kind of fuel—Semi-Steel Construction—Valve-In-Head Motor—WICO Magneto—THROTTLING GOVERNOR—Simple to run—Lifetime Guarantee—Excess Power.

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The Morley Phone for the  
**DEAF**  
is to the ears what glasses are to the eyes. Invisible, comfortable, weightless and harmless. Anyone can adjust it. Over one hundred thousand sold. Write for booklet and testimonials.  
**THE MORLEY CO., Dept. 797, 10 S. 18th Street, Philadelphia**

**GETTING AHEAD?**  
Read the advertisements on Pages 114 to 142 this issue if you want to get ahead.



## Better Shop Methods

### Old Bill Tests a Lathe

(Continued from page 104)

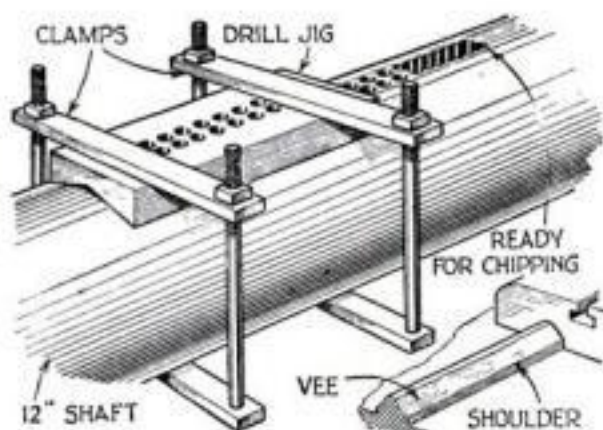
There was a shoulder on the vee where the carriage had been run back and forth. While this defect did not prevent the lathe from having a certain usefulness, Old Bill knew that it could not be depended upon to do highly accurate work.

"There are some other things in town I want to do," Old Bill told the proprietor, "and then I will be back to talk business with you."

"All right," he replied. "I shall be here all day."

Old Bill and Jones, the foreman, then took a turn about the shop by themselves.

"I have been wishing for a couple of days that I could see you," Jones remarked. "I have a job of the kind you like, and I don't know exactly the best way to get it done. One of the plants here has an engine driving a generator, and they have decided to put on another fly-wheel. There is room on the shaft, but there is no keyseat. The diameter is twelve inches, which means that we must



How the keyway was drilled through a jig; the worn shoulder on the old lathe vee

do a lot of chipping, yet that is the only way I see that we can get it done."

"I don't believe I would chip all of it," said Old Bill. "Drill most of it out, and chip just to finish it. If you will get a piece of steel and make a jig, you will be able to do a nice job, and quickly."

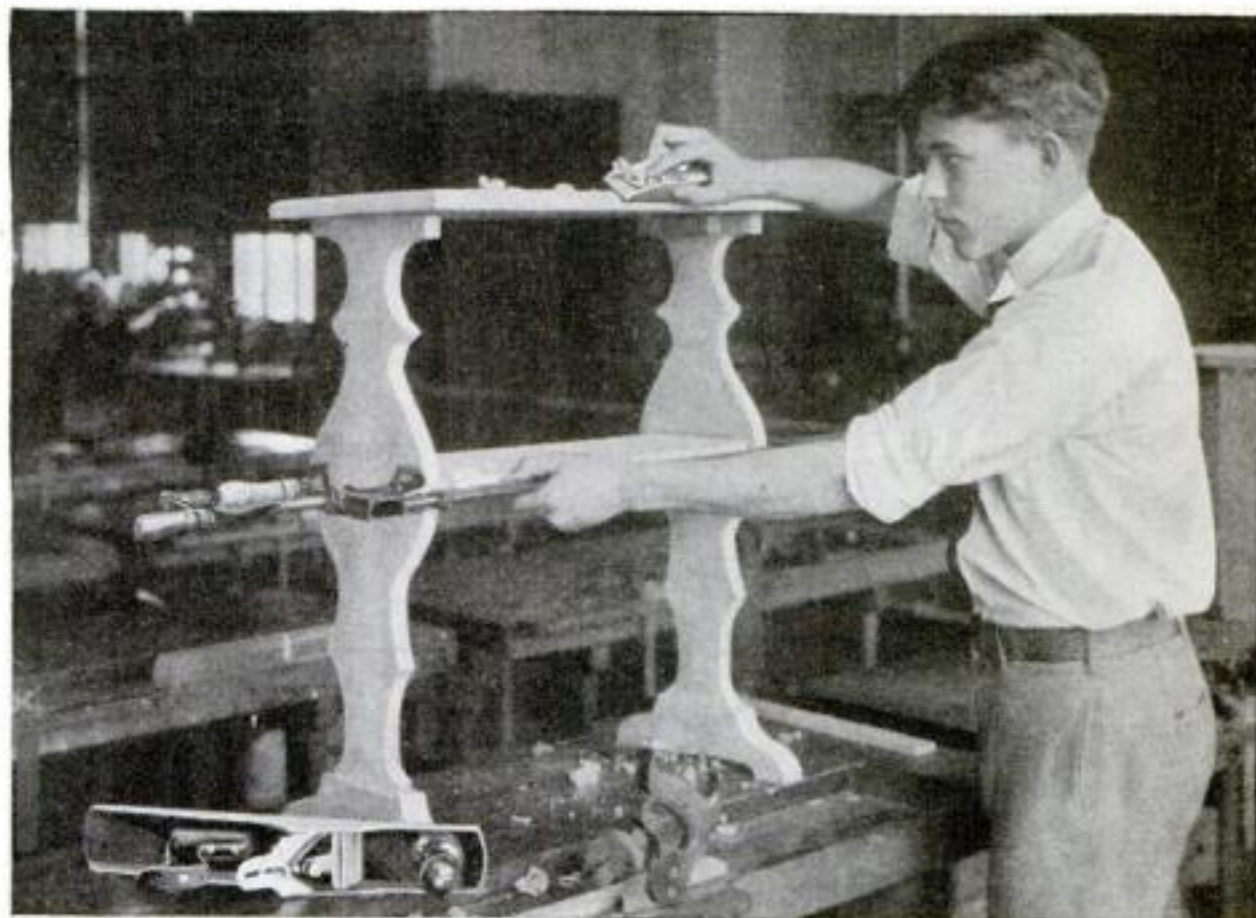
"We can only get at the shaft for three hours a day, so speed is what we are after."

"Well, I can't say that you will be able to do the job in one day, or two," Old Bill continued, "but here is a method that will speed it up: Take a piece of flat steel and plane a vee on one side of it. Then lay off one-inch holes all over the area of the keyseat so that there is about an eighth-inch wall between them. Clamp this on to the shaft and drill holes into the shaft all the same depth. Use a flat end drill to finish the bottoms. Now for the trick. Shift the jig along the shaft so that you can drill out the webs between the holes, and flatten these bottoms, too. Take off the jig, and all you will have to chip is a little on the bottom, and the high places off the sides."

"That sounds almost as good as a milling machine!" Jones exclaimed. "I knew that you would have some idea that would help me out on this job."

Old Bill started away on his next errand, happy in the thought that he could be useful to his "boys," even after they had left him and were no longer boys.

## He has good tools—his work shows it!



NO REASON now for anyone to work with unsatisfactory tools. In every class of tools there are leaders. Devised by workers who simply had to have something better than what they were using. Produced by manufacturers who have overlooked nothing that might better design and quality. Sold at prices which every worker can afford to pay.

Sargent planes will help you to get better results. Quicker results, because of their simplicity

of adjustment and ease of handling. The Auto-Set has a feature found in no other plane. The cutter may be removed, sharpened and replaced without changing original adjustment. With this and the small Steel Block Plane you can do practically every finishing job that comes to a school or home work-bench.

See them at your hardware dealer's. Prices are low for tools that so many professional carpenters use. Write for booklet.

SARGENT & COMPANY, Manufacturers, 50 Water Street, New Haven, Conn.

## SARGENT PLANES



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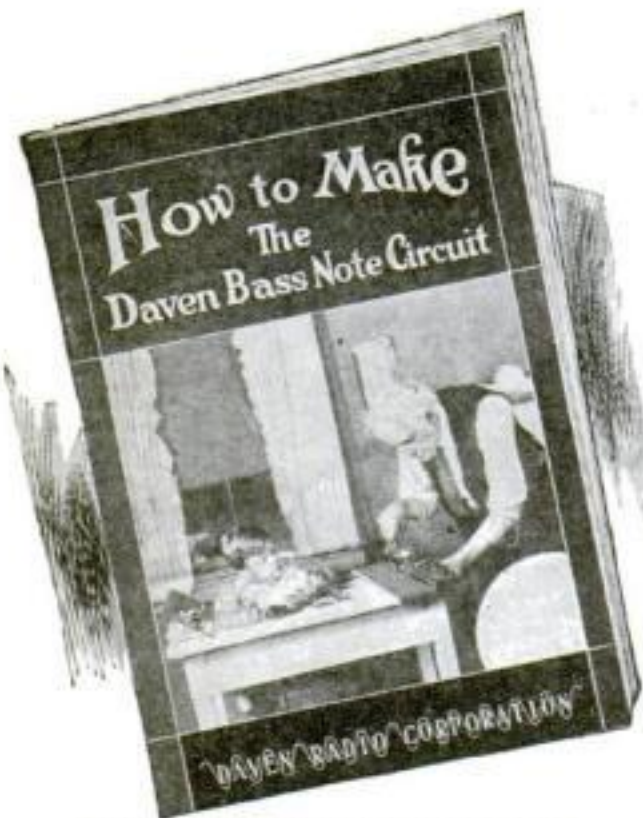


By new, easy methods you can learn to play a Conn saxophone in a few short weeks. Entertain yourself and your friends. Its zesty, cheering music makes you the life of the party; you're welcome everywhere.

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BAND  
INSTRUMENTS





This book tells you in a new, simple, direct way how to build this new radio set. 25c at Daven dealers, or 30c by mail.

## We GUARANTEE Your Success

**N**O MATTER if you're totally inexperienced in radio—you can build a successful 1928 model Daven Bass Note Set—we guarantee it! A set whose beauty and clearness of reception will be the envy of your friends. A set with a new purity and fullness of tone. A set that brings in all the deep notes in music, notes that are usually muffled or lost.

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If, after reading "How to Make a Daven Bass Note Circuit," you have the slightest difficulty, write us your problem, and our engineers—the men who perfected this circuit and designed the Daven parts which go into it—will give you personal advice and instruction.

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Shows how to assemble a Daven set that is economical of space; has simple two-dial control; equipped with new Daven Balancer and Compensator for sharp easy tuning. Charts of a new kind show every part lifeline, with exact measurements for wiring, etc. With its help you can build a \$150 radio set and save more than half of that. If your dealer hasn't this book send us 30c for a copy.

## DAVEN Bass Note Circuit for Complete Radio Reception

### Factory Built Daven Bass Note Sets

**I**F YOU are not interested in set building, but want the new completeness of reception, the easy 2-dial tuning, the sharp selectiveness that the Bass Note Circuit brings, you will be interested to know that we have bought a controlling interest in the Port Manufacturing Company of Newark. Write for Free Folder showing and describing complete Daven Bass Note Sets. Address:

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Complete Catalog of Daven Parts Free

## Better Shop Methods

### A Space-Saving Clothes Hanger for the Shop



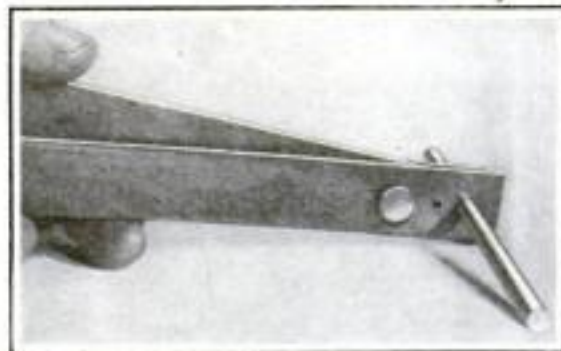
The hangers are suspended from nails high up, and quite out of the way

**O**NE of the best types of hat and coat hangers for the mechanic is, in my opinion, that illustrated above. An ordinary coat hook is fastened near one end of a 4- or 6-ft. stick. Just above the hook is a large hole, which allows the stick to be hung on a nail near the roof or ceiling. This makes it possible to hang one's street clothes high up, out of harm's way, in any crowded shop or building under construction.—JOHN H. ROBERTS.

### Sure-Grip Tool for Holding Short Dowel Pins

**I**LLUSTRATED below is a little tool, somewhat similar to tongs, that is better than fingers or pliers for holding dowel pins when starting them in holes. It will hold a very short pin, and one of almost any diameter.

The holder is made of two pieces of  $\frac{1}{16}$  in. thick flat stock. One is doubled



No matter how short the dowel pin is, it can be held with this homemade clamp

over to form a holder for the other piece; this is the bottom piece shown. The other piece is pivoted within the first. A hole large enough for the largest dowel pin that is to be used is drilled through all three thicknesses.

When especially neat section lining must be done on a drawing and no automatic section liner is at hand, a so-called railroad pen can be used, if available. One pair of blades is filled with ink; the other pair is left dry and serves for gaging the distance between lines.—L. M. S.



This is the FOKKER North Pole MONO-PLANE!

## Build and Fly Models of Famous Aeroplanes

There's no fun like building your own model Aeroplane. It's the most interesting job you ever tackled. Shows you how big machines are built. You can fly it too, right from the ground under its own power. Any bright boy can do it. Ideal Scale Drawings and Building-Flying Instructions show you how, and Ideal Model Aeroplane Construction Outfits contain everything needed. For 25 cents we will send you the complete plans for any one of the following famous Aeroplanes:

### Every Boy's Airplane

The finest ideas in Model Airplanes. Looks like a real one; clips together easily and quickly, ready to fly in 2 hours.

Fokker North Pole Mono-Plane; Curtiss J N 4 D-2 Training Plane; DeHavilland "Round the World Flyer"; N C-4 Naval Seaplane; Curtiss Military Tractor; Blériot; Nieuport or Taube Monoplane; or Cecil Peel Racer. Send 25 cents now and get plans for the one you want to build. (All 8 plans for \$1.50.)

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### THE PERFECT GRID LEAK



Provides a noiseless range of grid leak resistance from  $\frac{1}{4}$  to 10 megohms. Assures most effective grid leak resistance value for all tubes. Small grid condenser (0.00025) is separate. Metal parts nickel plated. One hole mounting.

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Electric Controlling Apparatus

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## Absolutely Guaranteed WADE BENCH LATHE

For Repair Shops, Amateur Mechanics, Model Makers, Inventors



who want a real, accurate machine tool at a price within easy reach. A complete shop in itself. Capacity 4 in. diameter x 12 in. length. Handles metal, wood and other materials.

Turning, facing, boring, drilling, winding, thread cutting. The "Wade" is a bargain at several times the price. Guaranteed a high degree of accuracy, quality of materials, workmanship and finish.

The slider rest has travel entire length of bed. Lead-screw inside bed. Hollow spindle.

No. 1 Lathe, plain headstock - \$28.00

No. 2 Lathe, back-geared - \$58.00

Either lathe with 18 in. length between centers, \$1.00 extra. Complete line of accessories.

By all means write for this free book.

THE GEROLD COMPANY

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Now, Only \$4.00 DOWN

Get This MARVELOUS NEW ENGINE with Easy Starting Device To Work For You.

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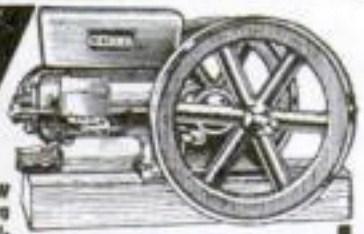
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OTTAWA MFG. CO., Desk 1951E Magna Bldg. Pittsburgh, Pa.

## A 2c Stamp

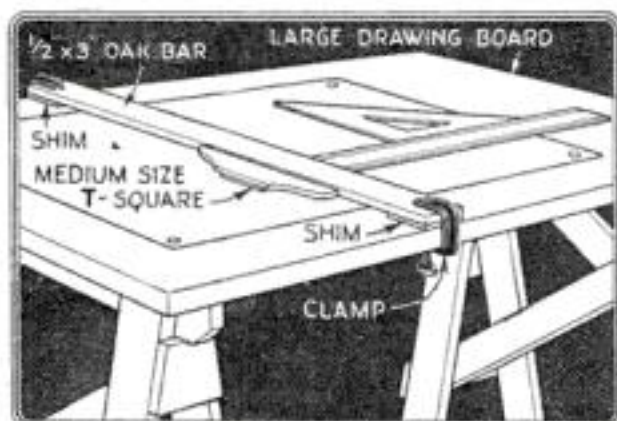
—will start you on the road to success. See Money Making Opportunities on pages 114 to 142.



## Better Shop Methods

### T-Square Guide Aids in Making Big Drawings

IN DRAFTING I often find it necessary to use the extreme right-hand side of my table, which cannot be covered conveniently or efficiently with the T-square. This is often the case in work-



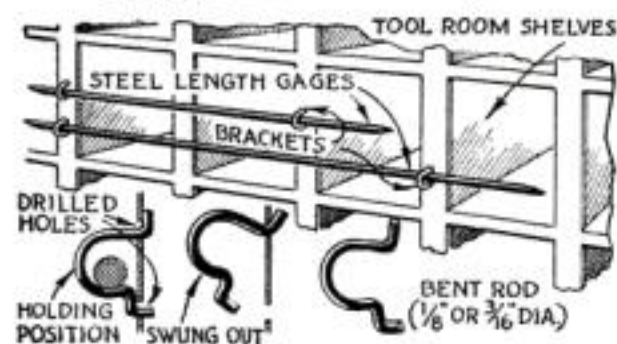
The guide bar in position for working at the right-hand side of a large drafting board

ing on large drawings, therefore I devised the simple expedient illustrated.

For the crosspiece I obtained a well seasoned piece of  $\frac{1}{2}$  by 3 in. oak, while the two small wood blocks or "shims" are of any wood that may be at hand.

It will be noted that the T-square is used in an inverted position, and that the flat steel clamps form one means of adjustment in changing the position of the device at will.—L. J. MISURACA.

### Wire Brackets for Storing Long Rods and Gages

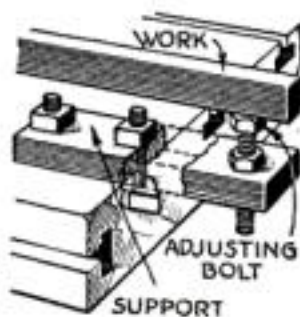


How the brackets are bent and inserted in the sheet steel shelving of the stock room

MANY shops use small rods for gages or length measures, yet it is difficult to store them without danger of bending them and destroying their accuracy. The illustration shows how small brackets may be fitted to the front of sheet steel shelving to hold the gages. The same type of bracket also is useful for holding drill rod stock.

### Support for Long Machine Work

OVERHANGING pieces on the milling machine, shaper or planer table may be supported by means of a bar bolted to the machine table as illustrated. A bolt allows work to be lined up.—G. A. L.



The extension braces any overhanging part



AC 12 - \$30



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*Amplion reproduces the whole range—perfectly*

TO the world-famous Amplion line of radio reproducers is added the Amplion Cone—time-perfected—clear and mel-

low in tone—strikingly distinct in the enunciation of the spoken word. In a graceful, two-tone mahogany cabinet, 14" x 14" x 9".

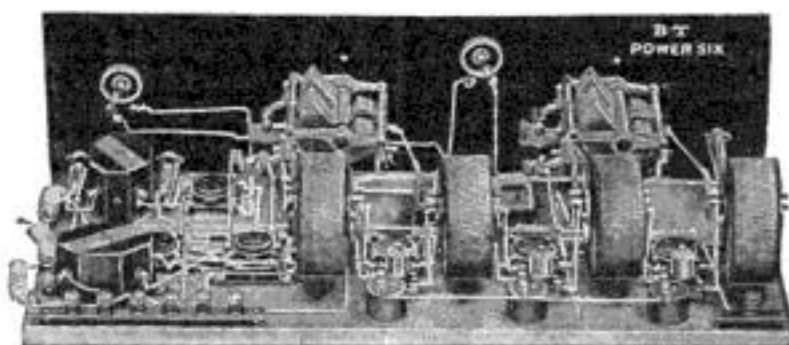
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## BREMER-TULLY POWER-SIX KIT SET



Gerald M. Best, Technical Editor and authority on Superheterodynes, says:

"The new Bremer-Tully Power-Six is by far the best Bremer-Tully Receiver yet developed.

"Its remarkable selectivity and simplicity of operation leads me to believe it will be one of the season's most popular circuits.

"It is one of the easiest circuits to wire of any I have seen. Its engineering principle is sound.

"Congratulations to Bremer-Tully on this new development."

Bremer-Tully has done more than design an extra good circuit and the parts to go with it—as Mr. Best says: "It is one of the easiest circuits to wire of any I have seen." B-T has made it easy to build. The parts are easy to buy—in a kit—and at less expense than if they were purchased singly.

Price of Power-Six Kit including essential parts, color diagram and instructions.....\$41.50

The full size colored picture wiring diagram and full instructions are also sold separately for.....\$90.

(If your dealer cannot supply you we will ship prepaid on receipt of list price.)

### Better Tuning

The Tenth Edition gives detailed information on the Power-Six. It also tells how to change the Counterphase to a Power-Six Model. B-Eliminators, new Counterphase Eight and many general radio subjects covered. Sent postpaid on receipt of 10c.

**BREMER-TULLY MFG. CO.**

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# Doctor Recommends This Tobacco to Pipe-Smoking Patients

There seems to be an unwritten law among pipe-smokers. When one man discovers a way to get more enjoyment out of his pipe, he feels obligated to tell the "pipe-smoking fraternity" about it.

So it is not surprising that when Doctor Gardiner of Florida found a tobacco that really enabled him to enjoy a pipe for the first time, he made a point of recommending it to all his pipe-smoking patients.

You'll find his letter interesting.

Larus & Bro. Co.,  
Richmond, Va.

Dear Sirs:

No harm done, I hope, if I feel like I want to say a word of praise for Edgeworth Ready-Rubbed.

I have tried many kinds of tobacco in a pipe, but until I got to smoking Edgeworth I never really enjoyed a pipe.

Frequently I say to patients who must smoke: "If you're going to smoke your pipe, use Edgeworth."

I like it and recommend it wholeheartedly to anyone who enjoys smoking.

Yours truly,

W. D. Gardiner, D.O.



Let us send you free samples of Edgeworth so that you may put it to the pipe test. If you like the samples, you'll like Edgeworth wherever and whenever you buy it, for it never changes in quality.

Write your name and address to Larus & Brother Co., 10M S. 21 St., Richmond, Va.

We'll be grateful for the name and address of your tobacco dealer, too, if you care to add them.

Edgeworth is sold in various sizes to suit the needs and means of all purchasers. Both Edgeworth Plug Slice and Edgeworth Ready-Rubbed are packed in small, pocket-size packages, in handsome humidor holding a pound, and also in several handy in-between sizes.

To Retail Tobacco Merchants: If your jobber cannot supply you with Edgeworth, Larus & Brother Company will gladly send you prepaid by parcel post a one- or two-dozen carton of any size of Edgeworth Plug Slice or Edgeworth Ready-Rubbed for the same price you would pay the jobber.

On your radio—tune in on WRVA, Richmond, Va. —the Edgeworth Station. Wave length 256 meters.

## Better Shop Methods

### Secrets of Boring

(Continued from page 72)

don't give you all you ask for. You see, it makes a great deal of difference whether you are roughing or finishing or whether you have a casting with scale in it or a plain piece of metal without scale. Also, the length and diameter of the hole and the machine you are using make a difference in the selection of a tool.

"NOW, take cast iron and bronze with cored holes—tools for those materials should be shaped as I showed you this morning, so as to get under the scale. Look at this sketch:"—and he rapidly made the drawing shown in Fig. 5—"here are two views of a rough boring tool for cored holes in cast iron or bronze. This is a forged tool, but the grinding would be the same if tools were in a boring bar. Now, notice the front edge of the tool has a back angle of five degrees or less. The clearance below the front edge is as shown by the dotted line. The clearances should be as little as possible and there should be no rake on the upper flat edge of the tool although it may have five degrees or so in the direction D. Now, a finishing tool for the same kind of material could be round nose as at E with clearance angles about the same as for the roughing tool. A little land (F) right behind the cutting edge gives a smoother cut and prevents the tool from digging in."

"What about tools for steel and aluminum?" asked Harvey. "They should be 'lipped,' shouldn't they?"

"A GOOD way to think of the cutting action is to consider the quality of metal, Harvey. Any metal which forms a long or curly chip in cutting should be worked with a tool having a lip, as you call it, so that it will separate the fibers of the metal easily. Aluminum and steel both have long grain and hence the tool should be ground so the chips will curl off as at H. This form of tool gives a clean cut and does not tear the metal. The clearance angles must always be great enough so there will be no drag."

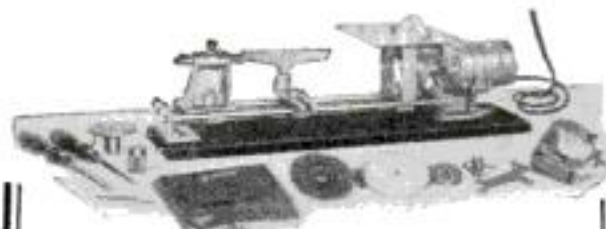
"What is the angle for the lip?"

"That is important. If you have too much back angle or side angle, the cutting edge of the tool breaks down quickly and the tool is also likely to dig into the work and chatter. Generally, for steel and aluminum or other soft metals, the back slope K should be eight or ten degrees and the side slope D fifteen or twenty degrees to give the best cutting action. You will find it an advantage to keep as close to these angles as possible when grinding your tools. I would use a protractor if I were you."

"All right, but I don't like to appear too fussy. Most men judge by the eye."

"If you are 'fussy' and this helps you to produce more and better work than your neighbor who is not 'fussy,'" Grimes commented drily, "I would say that you can afford to do it. Don't you think so?"

"I guess you're right," Harvey acknowledged as he said good night.



## Make Things at Home

You can make almost anything—Furniture, Garden Trellis, Flower Box, Toys, Radio Panel and Console and countless other things, with

### Speed Way Shop and Tools

A compact metal and woodworking outfit for mechanics, householders and "handy" men. Driven by the famous Speed Way motor. Tools quickly interchangeable.

#### 8 Motor Driven Tools

Bench Saw, Lathe, Jig-Saw, Grinder, Buffer, Portable Saw, Cleaner, Drill

Attach to any lamp socket and convert your bench to a complete private workshop. Have the chips flying in five minutes after receipt.

#### FREE INSTRUCTIONS

We furnish complete blueprints and instructions for making the items shown, and dozens of other useful articles with



Tea Wagon

#### Speed Way Shop

for your own home or for sale. You can buy two or three units at first and add others as you need them.



Pullman Nook

#### ONLY \$10 DOWN

We make it easy to pay while you enjoy these sturdy tools in your own home. You can do Wood Turning, Bench Sawing, Scroll Sawing, Portable Sawing. You can do buffing, polishing, grinding and drilling either at the bench or anywhere there is a lamp socket.

#### 10 DAYS' TRIAL

Test the Speed Way Shop for 10 days in your own home. If it does less than we claim, return it.

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## Better Shop Methods

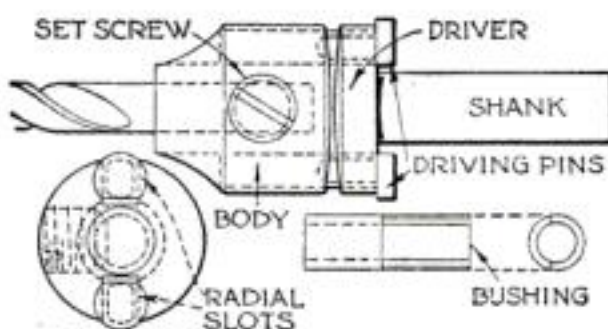
### Wobble-Joint Holder for Small Drills

By HENRY SIMON

**F**AULTY alignment in drill presses is a common defect. When drilling in small jigs, this fault often causes the jig to shake or vibrate, if it is not secured to the drill press table. Clamping the jig to the table does not always provide a remedy, because the mal-alignment still exists and is apt to manifest itself in poor work and lopsided wear on the drill bushings.

The wobble-joint drill holder illustrated has been found to do good work in cases where the smaller sizes of drills are used in production drilling.

The device consists of a body, in which a set screw engages a flat on the shank of the drill, and a driver, which is formed with a flange corresponding to the body. The shank of the driver is held in the drill chuck. Both driver and body have slightly semispherical contact surfaces and are linked by headed driving pins. These are driven firmly into holes in the body and engage in radial slots in the



The holder consists of two parts which have slightly rounded contact surface

driver head. The slots are deep enough to allow a shake of about  $\frac{1}{16}$  in. either way, and the driving pins are set down far enough to space driver and body away from each other by slightly more than what is necessary to compensate for the perpendicular error. As a rule, from .005 to .01 in. will be sufficient. The slots are made wide enough to accommodate the full diameter of the driving pins, and the pins are slightly flattened sidewise to give a better contact and allow some side play in the slots.

It should be noted that the driving pin holes go clear through the chuck body to allow the pins to be knocked out or adjusted easily.

Several sizes of drills can be used in the same holder by the use of reducing bushings.

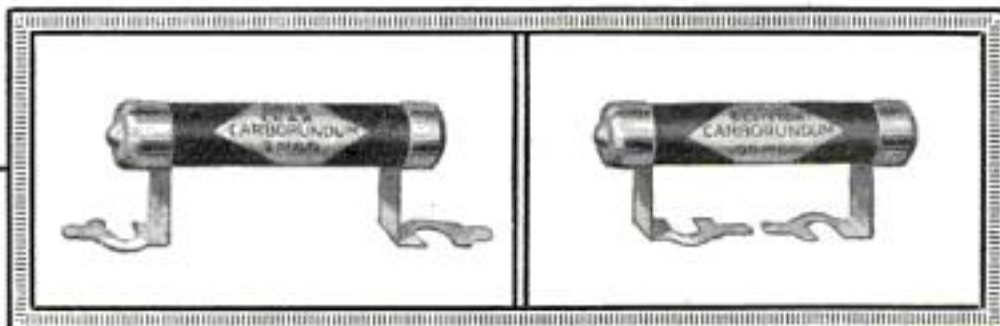
All parts of the chuck should be made from tool steel and hardened. For the body at least, it is best to use a non-shrinking steel. The drawing temperatures suggested are 560 for the body, pins and reducing bushings blue for the shank, and 450 for the working jaws.

In using the device it should be remembered that the drill press spindle assembly can be out of parallel alignment only one way. It should be ascertained which way it is out and the holder set to act approximately in the direction of the error.

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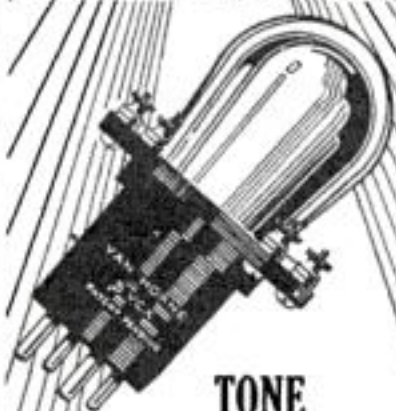


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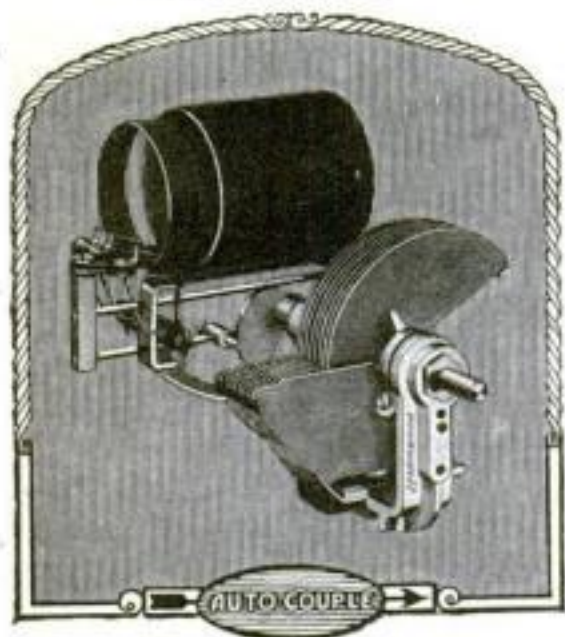
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## Better Shop Methods

### How to Grind Staggered Tooth Milling Cutters

**S**INCE the heavy duty spiral milling cutter of the alternate or staggered tooth type is coming into greater use, a few suggestions about the simplest way of resharpening it may be helpful. The two photographic illustrations show one of

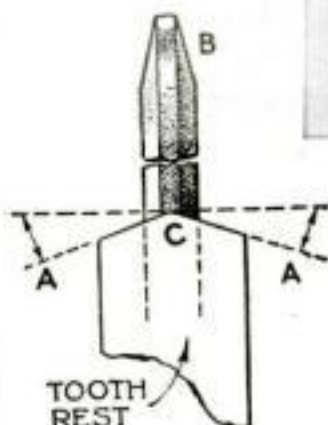


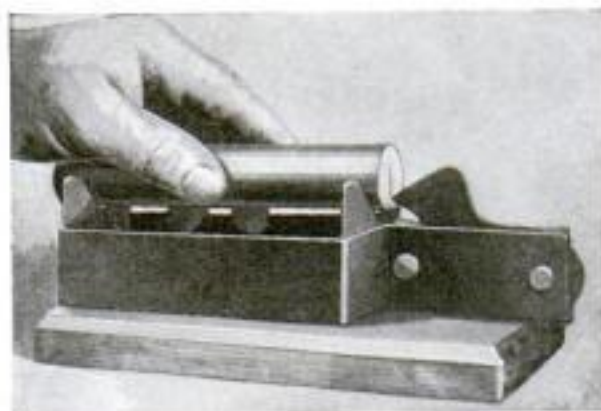
Diagram showing shape and location of rest (at left) and how it is used as a guide with alternate teeth (above)

the cutters on the grinding machine; the arrows indicate the direction in which the cutter should be moved across the face of the wheel. The diagram explains the kind of tooth rest used. The angles A should be equal to the helix angle of the cutter. The wheel B should be dressed very narrow, not exceeding  $\frac{1}{8}$  in. at the cutting edge. The apex of the rest (C) should be exactly in the center line of the wheel.

—H. B. SCHOTT.

### Automatic Scribing Device for Centering Shafts Quickly

**F**OR centering short shafts in one shop, an automatic V-block takes the place of loose blocks and a surface gage. The accompanying illustration shows the device in use. It is made entirely of sheet



As the shaft is pressed forward, the marker rises and automatically scribes a center line

steel. There are two vees for supporting the work and at the working end is a hinge pin for a scribing point, so arranged that the point will rise and draw a line when the chalked end of a shaft is pushed toward the hinge. A rubber band will serve to pull the marker down automatically.—H. MOORE.

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## Do Our Athletes Equal Stars of Old?

(Continued from page 10)

longer and be much more efficient. All that is necessary is to sit quietly for a few moments, allowing every muscle of the body to relax. This gives the blood its chance to carry off the poisons thrown off by the muscles while they are tensed. It is one of the easiest things in the world to do, but for some reason very few men will do it.

"I'm afraid that we have wandered away from the subject of our talk—whether the college athletes of today are as good as were the college athletes of twenty-five years ago. As I said before, I don't think that there is any difference in the great athletes—the exceptional men. But in one way at least the present college student is far ahead of the students of earlier days. A much greater number take an active part in athletics. Of the 4,000 men at Yale, 3,200 participate in some form of sport. The athletes of today may not be better than were the athletes of twenty-five years ago, but certainly there are more of them. That is a healthful sign.

"THE physical training value of the different sports varies. Football, for example, has little physical training value, for most of the men who play it already have well-developed bodies. But for moral training it is unexcelled. The football player learns to get up and go on fighting after he has been knocked down hard, and to go on fighting without feeling any animosity against the man who knocked him down. Can you think of any better training in manhood and in the practical sportsmanship that is needed so badly in business, political and professional life? I can't."

The students at other universities are as keen on active participation in sports as are the students at Yale. Of the 617 young men who entered Princeton last fall, 611 are taking an active part in some branch of sport. Among the upper classmen, last fall 250 men played in a "touch football" league composed of thirty-two teams. Touch football, by the way, is football without physical contact, except when the player with the ball is tagged.

NOT long ago, I asked Ernest W. Hjertberg, now track coach at Rice Institute, in Texas, and formerly coach of Swedish and Dutch Olympic Teams, how the present-day athletes differed from the athletes of the past. "They aren't willing to train as hard, if you are talking about American athletes," said the widely experienced Hjertberg. "Most of our athletes, especially our runners, are undertrained. That's why we made such a poor showing in track events at the last Olympics. The Finns and the other European athletes are made by hard, grinding work in training. Why, Nurmi has done more running in training than has been done by any dozen average American runners."

A glance at the American amateur running records shows that only a few of them have been on the books for twenty years or (Continued on page 112)



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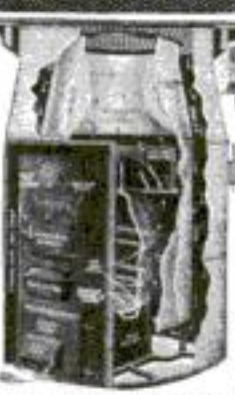


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## Do Our Athletes Equal Stars of Old?

(Continued from page 111)

more. The oldest of them all is the late Tommy Conneff's world and American record of 3 minutes 32 1/2 seconds for three quarters of a mile, which has stood unequalled for thirty-two years. Maxie Long's marvelous mark of 47 seconds for 440 yards straightaway stands after twenty-six years. E. B. Parsons' indoor record for the half mile was made in 1904. Most of the other records at standard distances have been made in the last ten years. The records of such cinder-path stars as Lon Myers, C. H. Kilpatrick, E. C. Carter and Mel Sheppard have been broken again and again. This would seem to prove that the track athletes of today are better than were the track athletes of a quarter-century ago, but Lawson Robertson, track coach at the University of Pennsylvania, and head coach of two Olympic teams, doesn't agree with that view. "There is more good coaching today," the likeable "Robbie" told me, "and as there are many more athletes in competition, it is only natural that more stars should be developed. But, everything considered, I doubt if some of those old boys ever have been beaten, or ever will be beaten, for natural athletic ability."

**FRANK SHAUGHNESSY**, football and hockey coach at McGill University, Montreal, and a man who has had a very extensive experience with both amateur and professional athletes, finds that there is a difference between the college athlete of today and the college athlete of ten years or so ago. "You can't drive these boys as hard," he told me recently. "I don't mean that they aren't game, for they are. But they have been brought up differently. They're not so hard as boys used to be. They've ridden around in automobiles instead of walking, and called on girls instead of doing the chores. They're all right—good boys—but you have to handle them differently."

Lieutenant Mott, the gymnasium medical officer at the United States Naval Academy, expressed the opinion that there had been no change in the boys who enter Annapolis, or in the athletes who represent the Navy. "The boys who come here," he said, "are a little more sophisticated than they used to be, and a little more fastidious in some ways. Officers who have been connected with the Academy for a long time agree with me that after a year's training the midshipman of today is the same animal as was the midshipman of twenty-five years ago—or even fifty years ago."

**"SPIKE WEBB**, boxing coach and instructor at the Naval Academy, had been listening in on our conversation. Now he produced a photograph. "If you think that American boys are going downhill physically," he said, "just take a look at this picture. It is of my last year's plebe boxing squad. There are twenty-nine youngsters in it, and they come from twenty-four States. Show me a better looking bunch of boys—past, present or future!"



## Wonders of Everyday Things

(Continued from page 42)

pendent raindrops. So, at the same moment, a race starts. The lightning flash, the noise of the thunder and the falling rain all start earthward together. The light travels 186,000 miles a second and gets in first. The thunder is more sedate and rumbles along at 1100 feet a second. The rain dawdles down at only twenty-five feet a second, so it reaches earth long after the thunder and lightning.

It doesn't always rain after battles, either, we learn, or on the Fourth of July. Battles are often fought in good weather, so naturally are followed by bad. Analysis of weather reports for ten to forty years before the Fourth became safe and sane shows that the day averaged neither wetter nor dryer than the days before or after. So there's no use, it seems, making a noise to start rain.

Mr. Humphreys has studied various means to produce changes in the weather and he thinks they are all "the bunk," including the new idea of sprinkling electrified sand or liquid air from airplanes. Likewise the Californian expedient of stretching electric wires. Rainfall in California is still substantially the same, he says. There is no way to control rain.

If you flatter yourself that you haven't any foolish ideas about weather, Mr. Humphreys will soon disillusion you. The moon does not control weather, he declares, except that there are sometimes slight changes in surface temperature on some straits and coasts when tidal changes have brought up a mass of cold water. Neither does the dew fall. It comes from adjacent air or oozes from grass.

### "Twenty Years in Borneo"

By Charles Bruce, Frederick A. Stokes Co.

THEY celebrate New Year's Day in Borneo by shooting poisoned darts from blowpipes at targets representing human heads.

The blowpipe, called a "sumpitan," is a deadly weapon. It is a six-foot tube of hard wood, an inch or so in diameter, with a handmade bore of about a quarter of an inch, so accurately bored that it looks like machine work. The darts are made of the rib of a palm leaf, fitted at one end with a plug of pith to fit the bore and sharpened at the other. The point is steeped in poison the composition of which is secret, but which, if fresh, causes death in five or ten minutes. Mr. Bruce, as he tells us in *Twenty Years in Borneo*, used an old dart on a monkey that was running amuck, and two minutes later the monkey dropped from a rafter to the ground and died almost immediately.

This poison is thought to be made partly from the upas tree juice. There is an antidote, but it is also a secret; the only way to avoid death is to excise the tissues about the wound.

In the New Year's Day shooting match, all the dark gentlemen who competed had to discard trousers, "chawats" or loin cloths being the uniform required by the rules. Yet civilization seems to have made some progress in Borneo, to judge from Mr. Bruce's interesting book. The head-hunters still hunt heads occasionally, but pretty far in the interior.



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5 resistances—2, 6, 10, 20, 30 ohms—\$1.20 each.

**Guaranteed Precision to 1/3 of 1%**

That's why Victoreen coils are so sharp tuning—that's why a Victoreen Super set is without a peer among radios. Victoreen Super sets are free from oscillations, howls or squeals—no matching of tubes is necessary. Range, clarity, volume, selectivity and ease of operation are all Victoreen features.

**Build a Victoreen**

**Use These Parts in Your Set:**

- 4 Victoreen No. 170 R. F. Transformers
- 1 Victoreen No. 150 Coupling Unit
- 1 Victoreen No. 160 Antenna Coupler (For use with outside aerial only)
- 2 6-ohm Victoreen Rheostats
- 2 30-ohm Victoreen Rheostats
- 1 400-ohm Victoreen Potentiometer
- 1 Victoreen Master Control Unit
- 1 Victoreen Audio Control

**Victoreen Master Control Unit**



A completely assembled unit with one dial reading controlled by a compensator on Vernier dial which compensates for any difference in the capacities of your condensers with 20 points on the dial. Used in circuits employing two or more condensers of the same capacity. Easy to mount—no change of wire necessary.

Free Victoreen folder and hook-up answers all questions about Victoreen circuit.

**THE GEORGE W. WALKER COMPANY** 6528 CARNEGIE AVE.  
 Merchandisers of Victoreen Products DEPT. I  
 CLEVELAND, O.



**TOOL CASES**  
for  
**MACHINISTS**  
and  
**TOOL MAKERS**

are shown in our new 1927 catalog. Thirty styles and sizes shown. A postal brings the catalog.

**H. GERSTNER & SONS**  
527 Columbia St., Dayton, O.



# DANGER!

Why risk life and limb erecting an outside aerial? Play safe by using Effarsen Antennae. Hang one indoors in 30 seconds, following directions we furnish, and get strong, clear reception! No danger of a fall. No lightning risks.

**EASILY INSTALLED**  
In attic, spare-room or closet—under carpets, behind pictures, drapes or furniture. Effarsen Antennae come in two handy sizes and work without interference from metal structural work, phone or light wires. Catch both sides of the radio wave and give you greater selectivity and a better tone practically free of static. Special parchment covering keeps wires properly spaced and insulated from moisture and electrical losses. Fixed condensers at each end provide the sharp tuning of a short aerial and the range and volume of a long one.

**FREE TRIAL**  
Effarsen antennae save you trouble and danger and improve results from your set. Try one on your set for ten days. You will be surprised and delighted. Send no money. Just give us your name and address and we'll send you your antennae C. O. D. for \$4.00. If you are not delighted we will refund your money. You take no risk. Send order now.

**Fiskwick Radio Co., Dept. 53,  
133 West Central Parkway, Cincinnati, Ohio.**

# PARKS

WOODWORKING MACHINES

**Cabinet Shop  
Special  
No. 10  
\$290  
with Motor**



You ought to have this handy Parks in your shop. It is a compact, complete machine designed just like a big production outfit at one-fifth the cost. Includes 8-inch circular rip and cross cut saw with polished cast-steel saw table, 16-inch band saw with tilting table for bevel-sawing, 6-inch jointer, and motor operating from any light socket. Just plug in and go to work! Fits in a corner of your basement. Does any kind of cabinet and joinery work. Add lathe, shaper and other attachments any time at small cost. For the man who does "odd jobs" in his off time this Parks is a big money maker. Turn out as much as a four-man shop working by yourself.

*Write for circular and Parks complete catalog of handy woodworking machinery*

**The Parks Ball Bearing Machine Co.**  
 1547 Knowlton Street, Cincinnati, Ohio  
 Canadian Factory: 208 Notre Dame East,  
 Montreal, Can.

Ⓢ This seal on a radio, tool or oil burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6. Copyrighted material



# Money Making Opportunities for Readers of Popular Science Monthly

## FREE RAILROAD FARE TO CHICAGO WHEN YOU ENROLL

You Can Learn  
Electricity  
in Only

**12  
Weeks**

—  
**Earn  
Up  
to  
\$200  
per  
Week**



Get PRACTICAL  
Training in the  
Great Shops of

**COYNE**

Student Winding Stator

## You Can Earn More in Electricity

Get training in the Clean, Fascinating Profitable Field of **ELECTRICITY**. **COYNE-Trained Men Are in Demand**. Here's a proposition that should arouse the enthusiasm of every red-blooded, ambitious fellow. Why not make this your happiest and most profitable season? Come to Chicago, the great, interesting city and place of big opportunities. I'll pay your railroad fare here, and you can prepare yourself, in 12 happy weeks at **COYNE ELECTRICAL SCHOOL**, to join the ranks of successful **Big Pay** men. Why gamble on other lines of work when the field of Electricity offers millions of amazing opportunities?

### Complete Electrical Training in 12 Happy Weeks

—Not by Correspondence—All Practical Work—

I have started thousands of men, young and old, on the road to success and independence. I can do the same for you. I teach you everything in

Electricity from A to Z, by practical instruction. Nothing that will help to make you a success is left out.

### Experience, Education—Not Needed

I can teach you electricity in 12 weeks, regardless of your education or experience because I teach you every detail in a simple, logical, PRACTICAL manner, letting you work out problems on thousands of dollars' worth of modern electrical apparatus in my great **COYNE** shops. My instructors are trained men with years of experience.

### Learn in Chicago, Electrical Center of the World

Chicago is the greatest electrical and industrial center, therefore it presents real opportunities for you. Along with my shop training you visit

the big industrial organizations and power plants and see every kind of electrical equipment in operation, on every kind of job, under all conditions.

### EARN While You LEARN

My Employment Department helps you get a job to earn a good part of your expenses and assists you to a good job on graduation.

### Hear WGES on the Air

Listen in on **COYNE** Radio Station **WGES**; wave length, 250 meters. Always an interesting program.

## Send Coupon for Big Free Book

H. C. Lewis, President

**Coyne Electrical School**

1300-10 W. Harrison St., Dept. 17-73  
Chicago, Illinois

Dear H. C.—I sure want one of those big handsome 12x15 books with 151 actual photographs printed in two colors. Send it quick without obligating me. Also tell me about the Free Railroad Fare and Two Free Courses.

Name.....

Address.....

Town..... State.....

Right now I am making one of the greatest offers ever made by a Practical Training Institution. My offer includes **FREE RAILROAD FARE** to Chicago from any place in the U. S.; also extra special **FREE** Radio and Auto Courses. Be sure to send the coupon **AT ONCE**, even if you are not planning to come immediately.

**COYNE**  
**ELECTRICAL SCHOOL**

Founded 1899—27th Year

H. C. LEWIS, President

1300-10 W. Harrison Street  
Dept. 17-73 CHICAGO, ILL.

## \$25 in CASH PRIZES

For the best letter of 170 words or less answering the question—

*“What advertisement in the ‘Money-Making Opportunities’ Section interests you most—and why?”*

we will pay on February 10th the following—

### CASH PRIZES

First Prize	\$10.00
Second Prize	5.00
Third Prize	3.00
Seven Prizes of \$1.00 Each	7.00

First read every advertisement in the Money-Making Opportunities Section on pages 114 to 142. Pick out the one that interests you most and then write a letter—not exceeding 170 words—telling us why you find the advertisement you have selected the most interesting.

Entries for the contest will close on January 3rd. The prize winners and their letters will be published in the March issue of **POPULAR SCIENCE MONTHLY**.

Address your letter to

Contest Editor

MONEY-MAKING OPPORTUNITIES  
**POPULAR SCIENCE MONTHLY**  
250 Fourth Ave., New York

### PRIZE WINNERS

in the November Contest

#### FIRST PRIZE \$10.00

Raymond Block, Spokane, Wash.  
(National Salesmen's Training Assoc.)

#### SECOND PRIZE \$5.00

Victor Dyer, San Francisco, Calif.  
(American School)

#### THIRD PRIZE \$3.00

Sorchi Nakagawa, Kealia, Kauai, Hawaii  
(National Radio Institute)

PRIZE WINNERS who receive \$1.00 each for their letters:

Rev. Raymond Sonnek, Pulaski, Wis.

(Washington School of Cartooning)

T. M. McEwan, Springfield, Mass.

(La Salle Extension University)

Thomas P. Smith, New Orleans, La.

(Sherwin Cody School of English)

Marcy C. Brown, San Jose, Calif.

(Fireside Industries)

Patrick Brady, Kimball, S. D.

(Federal School, Inc.)

Alfred Albert Schultz, Cat Springs, Texas

(Dodd, Mead & Company)

R. E. Stanley, Detroit, Michigan

(American School of Aviation)



## Jumps From \$3 to \$26 a Day

Mr. Cooke: If it had not been for your Course I would still be plugging away for \$3 a day. Instead I have all the work I can do and my earnings run as high as \$23 to \$26 a day. I owe all my success to your training.—Edward A. Lehmann, 1521 Market St., Oakland, California.

# They Know How to Get the Big Pay

**Will You Learn the Secret of Lehmann's and Hines' Success?**

**Mail Coupon for Free Book That Tells All**

**\$26**  
a day

## \$85 a Week —and Going Up!

Dear Chief: With your Course and your great help and encouragement, I am going right over the top. I am making \$85 a week now and still going up. I had only a common school education when I started with you and no electrical experience. Your lessons were easy and clear and I owe my success to you.—R. M. Hines, 1664 Aberdeen St., Chicago Heights, Ill.

IT sounds too good to be true—it's hard to believe—that thousands of men like the two pictured here could step out of small pay, no future jobs and earn \$3500 to \$10,000 a year in Electricity. Yet that's just what many hundreds of men have done. Most of them had no previous experience—all of them kept right on with their regular jobs and used spare time only, to prepare for the big-pay jobs they hold.

What was "the something" that brought these men big-pay and quick success? What makes it possible for them to earn from two to four times more than you are able to earn working hard every day? They couldn't have used ordinary methods because other men who tried them have failed. They must have gotten hold of something new—something different—something that matches electricity itself. And electricity, you know, is the world's greatest business, growing with leaps and bounds every year and continually demanding more and more trained men.

No matter what you may have heard about home-training—no matter what kind of work you are doing now—you owe it to yourself to find out the secret of these men's success—to find out about Cooke Training which has already lifted hundreds of other men into the big-pay class, and which today offers you one of the world's greatest opportunities.



**L. L. COOKE**

He is Chief Engineer of the Chicago Engineering Works, Inc., and has trained and helped hundreds of men into big-pay Electrical Jobs.

Chief Engineer Cooke has prepared a wonderfully interesting book printed in colors with 64

pages and over 100 pictures, telling all about electricity, the opportunities it offers young men and what these opportunities mean to you. This is the same book that started so many other men on the road to big pay. It's free and it may help you like it helped them. Anyway send for the book and decide for yourself. There is no obligation on your part and no agent will call on you. Mail the Coupon Now, to—

**L. L. Cooke, Chief Engineer**

## L. L. Cooke School of Electricity

Owned and Operated by

**Chicago Engineering Works**

INCORPORATED  
2150 Lawrence Ave. Chicago, Illinois

**L. L. Cooke, Chief Engineer**

Dept. 31, 2150 Lawrence Ave.,  
Chicago, Illinois

Send me your free book about Electricity and proof that the men you have trained are holding big pay jobs. I understand no agent will call on me and I won't be obligated to take your Course.

Name .....

Address .....

City..... State.....

**\$85**  
a week





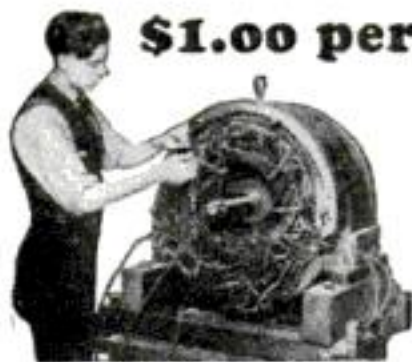
# This funny juice~



- helps to run automobiles
- makes radio possible
- makes your telephone work
- makes the wheels go round in thousands of factories
- illuminates homes, factories, office buildings and city streets
- toasts bread, percolates coffee and heats flat-irons
- runs street cars and fast trains

No one knows what it really is—it is called Electricity—but you can learn how to handle it.

## —AND IT WILL PAY YOU



A 35 H. P. Motor for student practice

## \$1.00 per Hour to \$25,000.00 per Year

If you get a real "kick" out of this subject of Electricity you're **crazy** if you don't make it earn you real money. Pretty plain speaking—but I want to make you **think**. The world's greatest, most successful men were men who worked at things **they liked**. Work is fun if you like your job. If **YOU** like electricity, **make it pay you real money**.

### HERE'S YOUR CHANCE

To get somewhere you've got to start, haven't you? It'll mean breaking away from home for about 12 weeks—but you and the family will be mighty glad you **started and finished** something. Especially something that pays so big.

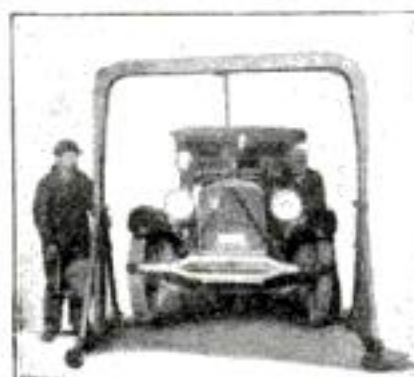
We'll take mighty good care of you here in the big Greer Electrical Shops. You'll be in company with hundreds of men temporarily away from home, like yourself. And you'll learn Electricity—**oh man**—how you'll learn it! You'll marvel at the way a subject apparently so mysterious is made so easy to understand. Just wait till we turn you loose among our hundreds of motors, rotary converters, generators, telephone and radio equipments. Competent, friendly instructors will show you how to take 'em apart and put 'em together till you can do it in your sleep.

### HOW TO GET THIS TRAINING

The coupon at the bottom of this page is the open door to pleasant work and big money in the Electrical Profession. We can't tell the whole story here because it takes a Book to tell it. The book is free. Mail the coupon, and be thankful the rest of your life for doing it.

### WHAT ABOUT AUTOMOBILES?

Maybe automobiles interest you as much as electricity—or more. There's a lot of money in fixing autos, too. The well trained auto man is never out of a job. He's ready to go in business for himself. Would you like that kind of work? \$6 a day to \$20,000 a year is what it pays you.



Using a Wrecker crane on the repair floor of the Greer shops

ERWIN GREER, President, Greer College  
Dept. 201, 2024 S. Wabash Ave., CHICAGO.  
Please send me your FREE BOOK and offer for Electrical ☐ Automotive ☐ course.  
It is understood I am not obligated in any way.

Name .....

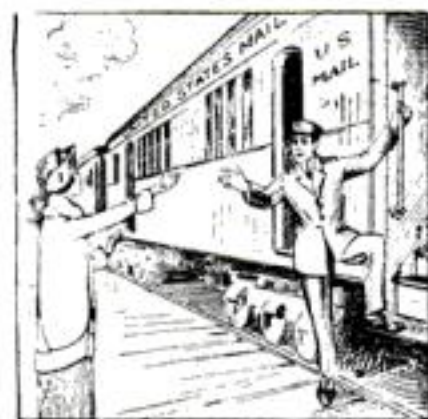
Address .....

Then mark the coupon for the free book on our Automotive Course. We've made automobile experts out of thousands of men who didn't know a carburetor from a universal joint when they came to our big training shops. How much does it cost? You'll be surprised to learn **how easily you can afford it**. Mail the coupon **NOW** for complete information.

**Greer College of Electrical Trades**  
Dept. 201 2024 S. Wabash Ave.  
CHICAGO, ILLINOIS

## Make More Money

Read the Money Making Opportunities on pages 114 to 142 of this issue.



## TRAVEL FOR "UNCLE SAM"

RAILWAY POSTAL CLERKS \$1900 to \$2700 YEAR  
Mail Carriers—Post Office Clerks

MEN—BOYS 18 UP  
Steady Work. No Layoffs  
Paid Vacations

Common Education Sufficient  
Travel—See Your Country

Many U. S. Govt. Jobs  
open to women

MAIL COUPON  
IMMEDIATELY

COUPON  
FRANKLIN INSTITUTE  
Dept. D-271 Rochester, N. Y.

Sirs: Rush to me, without charge, (1) Sample Railway Postal Clerk coaching lessons; (2) List of U. S. Government jobs now open to men and women, 18 up; (3) send 32-page book, "Government Jobs."

Name .....  
Address .....

## IN 1927

### Follow the Success Road

A year ago Raymond Block was working in a saw-mill for 42c an hour—less than \$25 a week. Today he is making \$75 to \$100 a week and not working nearly as hard as when he was making less than \$25 a week. He increased his salary by recognizing an opportunity when he saw it.

Would you like to make three to four times your present salary? Of course you would. Then do what Raymond Block did. Go through the Money Making Opportunities Section of this magazine (page 114 to 142), pick out the opportunities that appeal to you most and write the advertisers for their booklets and other information that tells about the men they have helped to make more money.

How one reader of POPULAR SCIENCE MONTHLY achieved success through an advertisement just like those in the neighboring pages is told by Mr. Block of Spokane, Wash.

### Contest Editor:

The advertisement that interests me most in the "Money Making Opportunities" section of POPULAR SCIENCE MONTHLY for November is that of the National Salesmen's Training Association.

A year ago today I was working at a sawmill for approximately forty-two cents an hour, with no chance for advancement, for men who had been there for twenty years were only receiving a few more cents a day than young men who had only been there a short time.

Today I am making between seventy-five and one hundred dollars a week as a salesman, with a great repeat business. I attribute my advancement and big increase in salary to persistent effort, and to the splendid method which the N.S.T.A. use in teaching their course.

I recommend the N.S.T.A. to anyone, especially to those who were unfortunate in not receiving a high school education or better, for the course can be mastered with only a common school education.

Very respectfully,

Raymond Block

Raymond Block's letter wins the First Prize of \$10 for the best letter telling about the advertisement in the "Money Making Opportunities" Section that interested him most. The other prize winners in this month's contest will be found on page 114.

Here it is the first of a new year. Resolve now to make it the year that will spell S-U-C-C-E-S-S for you; financial independence and all the pleasures and benefits it will bring you and your family to have an income greater than your hand-to-mouth needs.

Make 1927 the turning point in your life. Follow in the footsteps of Raymond Block—write the advertisers whose offers you find most interesting and let them help you find the Success Road. They have helped thousands of others and they can help you gain success and financial independence. Write them today.



# CAN SUCCESS BE GUARANTEED?

## Get this Million-dollar Institution back of you!

Three powerful services here: *Training*, to prepare you. *Employment*, to place you. *Consulting*, to help you win promotion and increased pay.

You can get ahead faster with *training plus practice* than by "experience" alone. You'll find it *easier* to get a good job and *keep it* with this great school to recommend and advise you, than going it *alone!*



O. C. MILLER

Director Extension Work

I represent the interests of our thirty thousand students. My job is to see that they get what they enroll to get—preparation for a better job, then help in finding it.

## Go to School at Home

The AMERICAN SCHOOL is one of the largest in America, serving 30,000 students each year, *in their own homes!* Chartered 30 years ago as an educational institution, *not for profit*, like the best resident schools and colleges. If you were denied specific training for your chosen line of work, look into this opportunity to secure the very finest kind of instruction, prepared by over 200 noted engineers, educators and executives.

# A Better Job!

## Bigger Pay

Read my refund Guarantee:

Right in your own home, in spare time, at a cost easily within your reach, we undertake to give you the *specialized training* that you need to get ahead. Even if you lack confidence in your own ability to master the necessary instruction, **WE DO NOT.** If you are now earning \$40 a week or less, if you have common schooling or better, we will prepare you for a position paying at least 50% more than you earn today within 60 days after you finish this training *or refund your money.* Our money-back guarantee relieves you of all worry, all risk—assures you of getting all the benefits you expect to derive from your training.

## I want to send you White Magic FREE!

Here's truth, stranger than fiction. *True stories* (hundreds of them) told by AMERICAN SCHOOL students and graduates. Of struggles to get ahead. Success won in the face of bitter difficulties. *White Magic* will make you say—"By George! I can, too!" Read it—*coupon brings it FREE!*



## Guaranteed Training —the sure way to success!

If you've reached the point where you're wondering about your future in your present job and line of work—if you've come to see that a man must educate himself for some *one special line* if he expects to earn money enough to enjoy the good things of life. If you're tired of hard, monotonous work at small pay, and feel that *with training* you can make as much money and as rapid progress as *anybody.* If you're wondering if **YOU** can break into Electricity or Drafting or some other well-paid line of work where there are real opportunities for promotion—*then get in touch with me immediately!* I will tell you how the AMERICAN SCHOOL will guarantee to help you make good in the line you choose.

O. C. Miller, Director Extension Work

## American School

Dept. G-175, Drexel Ave. and 58th St., Chicago

## In which of these five great opportunities are you interested?

O. C. Miller, Director Extension Work, American School, Drexel Ave. & 58th St., Dept. G-175, Chicago, Ill. Send me your agreement to help me find a better job at increased pay, your free book, "WHITE MAGIC," and facts about the opportunities in line marked X, below:

☐ **Electricity** A billion dollar industry, growing faster than ever. Offers unlimited opportunities.

☐ **Drafting** The key to progress and success in all building and engineering lines. Easy to learn by our new method.

☐ **Auto** There are now nearly 20 million cars, trucks, tractors,

and buses to service in addition to 4 million new cars each year.

☐ **Business** A knowledge of Accounting, Advertising, Management, Finance and Production are necessary if you would gain promotion and success in Business.

☐ **High School** In 2 years prepares for college and gives the necessary educational foundation for success in business.

Name.....

Street No.....

City.....State.....



# Opportunities for Readers in Quick Action Advertising

## Adding Machines

FREE trial. Marvelous Calculator. Adds, Subtracts, Multiplies, Divides automatically. Work equals \$300.00 machines. Five year guarantee. Price only \$15.00. Write today for free trial offer. Special: \$3.00 Pocket Calculator, only \$2.00 cash. Lightning Calculator Co., Dept. O, Grand Rapids, Mich.

## Advertising Services

ADVERTISE in 24 metropolitan dailies, 24 words, \$15.00. Helpful Guide listing 1000 publications, 4c stamps. Wade Company, Baltimore Bldg., Chicago.

24 WORDS-151 rural weeklies, \$6.04. Ad-Meyer, 4112P Hartford, St. Louis, Mo.

COPY that gets orders—Folders, Booklets, etc., that pull. Hewson, City Centre Building, Phila.

ADVERTISERS' Manual: New edition. Inside information for advertisers. Postpaid, 50c. Economics Publishing Co., Dept. 54, 1475 Broadway, N. Y.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

## Authors and Manuscripts

888 FIB Ideas. Photoplay Plots revised, criticized, copyrighted, marketed. Send for free booklet. Universal Scenario Company, 238 Security Bldg., Santa Monica & Western Ave., Hollywood, Calif.

SONG—Poem writers. Address Monarch, 1472 Broadway—Dept. 126, New York.

SONG Poem Writers—Send for proposition. Ray Hibbeler, 1910, 2104 N. Keystone Ave., Chicago.

SONG Poems Wanted. Ambrose Thomas. Write, Box 327, Norwalk, Ohio.

I WANT song poems. Casper Nathan, J-3544 No. Racine, Chicago.

## Automobiles and Accessories

DELIVERY bodies for Ford Model T. Chassis with enclosed cab, suitable for Contractors, Grocersmen and Farmers. Three styles. Price \$42.60. Write Daniel Zimmerman, Craigville, Indiana.

NEW and used auto parts. Save 25-80% Motors Rear ends, Radiators, Wheels, Generators, Starters Carburetors, \$5.00 up. Complete Tops \$15.00. Gears Axles, Bearings, Nickel Spring Bumpers. Brightman Auto Parts Co., 321 Windsor Ave., Hartford, Conn.

HUDSON Owners. We stop Piston Pin Knock, Oil Pumping, Piston Slap. Write for information. Everts Machine Co., Hartford, Conn.

## Aviation

THE American School of Aviation announces a new correspondence course in mechanics of aviation. A thorough training in practical aeronautics. American School of Aviation, Dept. 6741, 3601 Michigan Ave., Chicago, Illinois.

LEARN to Fly! Write for booklet. Robertson Aircraft Corp., Anglum, Mo.

WANTED Ten Men! Interested in earning tuition at aviation school. Send 25c for illustrated booklet and details. Aeroplane Dept., Box 502, Peoria, Ill.

"BIG Special Christmas Offer." Curtiss Pulitzer Racer Construction Set. Scientific Airliner. One Year's Subscription Aero Digest. All for \$6.00. Canada 50c Extra. Send 5c for Big Model Airplane Boat & Supply Catalog. Phipps Airplane Company, 367 Wilson Ave., Brooklyn, N. Y.

"BOYS, send dime for a 12-inch mounted propeller and circular telling how you can get a three-foot model aeroplane free. Aero Shop, 3050 Hurlbut Ave., Detroit, Mich."

AERO Dope Sheets give specifications 159 different airplanes, 16 to 4000 horsepower, and 76 aeronautic motors; span, weight, power, type, area, etc. Postpaid, \$2. Send now and get posted. Pacific Aero Company, Box 3090, Portland, Oregon.

## Boats and Launches

COMMENCE now, build your own boat for this season's use. 55 Models 9' to 40'. Send 25c today for complete catalog. Brooks Boat Co., Inc., Salt Street, Saginaw West Side, Mich.

## Books and Periodicals

AUTHORS: our co-operative plan produces and publishes your book. Meador Publishing Company, 27 Beach, Boston, Mass.

## Branch Offices

CINCINNATI Address. \$3.00. Forwarded Daily. Thompson Service, 518 Oak St.

Rates 30 Cents a Word. A 10% discount is allowed on all contracts for six consecutive insertions. Advertisements intended for the March, 1927 issue should be received by Jan. 5th.

## Business Opportunities

USED correspondence school courses. All kinds. Sold on re-purchase basis. Big saving. Money back guarantee. Lists free. (Courses bought.) Lee Mountain, Pisgah, Alabama.

LEARN the collection business. Good income; quick results. Interesting booklet, "Skillful Collecting," free. National Collector's Association, Science Building, Newark, Ohio.

BECOME a Foot Correctionist. A New Profession not medical nor chiropody. All the trade you can attend to; many are making \$3,000 to \$10,000 yearly, easy terms for training by mail, no further capital needed or goods to buy, no agency or soliciting. Address Stephenson Laboratory, 10 Back Bay, Boston, Mass.

STOP plodding! Be successful. Operate a tire repair shop. Make big profits in any locality. We teach you and furnish complete equipments, \$100 up. Book of Opportunity free. Haywood's, 1306 South Oakley Avenue, Chicago.

PATENTS procured: Trade Marks Registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard H. Owen, 44 Owen Bldg., Washington, D. C., or 41-Z Park Row, New York.

WE Start you in business, furnishing everything. Men and women, opportunity to earn \$35 to \$100 weekly operating Ragsdale's original "New System Specialty Candy Factories" anywhere; wholesale or retail. Big commercial candy book free. W. Hillyer Ragsdale, Drawer 19, East Orange, N. J.

SCHEMER, Alliance, Ohio, 36p monthly, prints mammoth 8-getters. Subscriber reports \$25,000 from three; another \$10,000 from one. Try your luck. Year, \$1.00; 3 months, 30c. None free.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

"\$50.00 WEEKLY mailing form letters. We furnish everything. Samples and particulars 10c. Whitney Co. Station C, Cincinnati, Ohio."

MIRRORS resilvered at home. Costs less 5 cents per square foot; you charge 75 cents. Immense profits, plating like new; brassy worn-off auto parts, reflectors, tableware, stoves, etc. Outfits furnished. Details free. Sprinkle, Plater, 94, Marion, Indiana.

SIGNS and Showcards easily painted with Letter Patterns. Large variety of styles and sizes. Write for free samples. John Rahn, D 2120 Neva Ave., Chicago.

FREE folder, start spare time mail order business. T. Johnson, Box 524, City Hall Station, New York.

MEN—Women: make \$20 daily. I did. Sample Articles, Plans, 10c. Nameyer, Euters, Penna.

ADVERTISE in 400 country newspapers, 28 words, \$10.00. Keator, Hartford Bldg., Chicago.

MODERN Mail Order Methods. A new book that tells how to operate a mail order business successfully. Write for free circular. Patrick-Mahoney Co., P. O. Box 931, Schenectady, N. Y.

MINIATURE die-casting machines \$50.00. Byrd—318 Reed, Erie, Pa.

CAPITALIST—Wanted. Griffins Patented Propeller Tested—Marine and Aeroplanes. Converts slipcase into propulsion. High speed. Less Revolutions. Griffiths, 62 Sudbury Street, Boston, Mass.

GETIT! Test It! Chemicals Free with Order. Rae's Process of Silvering Mirrors. Write Rae's Mirror Works, Amherst, Nova Scotia.

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PECAN-Orange-Fig Groves "On the Gulf" Monthly payments. Guaranteed care. Big, quick returns. Suburban Orchards, Dept. "8", Biloxi, Miss.

### Salesmen and Agents Wanted

AGENTS—Clever inventor! Inkspoon makes every pen a fountain pen. Fast office seller, big profit, demand increasing everywhere. Exclusive territory offered. Sample free. H. Marul Company, Tribune Bldg., New York.

INSTANT Weld—Repairs large punctures without cement or heat. Lenn's profit one day \$56. Write quick. Free sample. Territory going fast. Tourist's Pride Mfg. Co., Desk R, Minneapolis, Minnesota.

GET our free sample case, toilet articles, perfumes and specialties. Wonderfully profitable. La Derma Co., Dept. F., St. Louis, Missouri.

AGENTS. \$60—\$200 a week. Genuine gold letters for store windows easily applied. Free samples. Liberal offer to general agents. Metalite Letter Co., 434-A N. Clark, Chicago.

TAKE orders for coffee, sugar, flour, meats, canned goods, staple groceries, also paints, radio sets, tires, auto and tractor oils. No capital or bond required. We deliver and collect. Permanent business. Big pay. Write at once. Hitchcock-Hill Co., Dept. 81, Chicago.

BANKRUPT and Rummage Sales. Make \$50.00 daily. We start you, furnishing everything. Distributors Dept. 34, 609 Division, Chicago.

\$10 DAILY silvering mirrors, plating and refinishing lamps, reflectors, autos, beds, chandeliers by new method. Outfits furnished. Write Gunmetal Co., Ave. F, Decatur, Illinois.

AGENTS—Best seller; Jem Rubber Repair for tires and tubes; superseded vulcanization at a saving of over 800 per cent; put it on cold, it vulcanizes itself in two minutes, and is guaranteed to last the life of the tire or tube; sells to every auto owner and accessory dealer. For particulars how to make big money and free sample, address Amazon Rubber Co., 504 Amazon Building, Philadelphia, Pennsylvania.

BIG money and fast sales. Every owner buys gold initials for his auto. You charge \$1.50; make \$1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 47, East Orange, New Jersey.

AGENTS—Stamping names on Pocket Key Protectors; sample check with your name and address, 25c. Stamping Outfits, Emblem Checks, Check Fobs, Name Plates, Hart Mfg. Co., Desk 2—305 Degraw St., Brooklyn, N. Y.

### Salesmen and Agents Wanted

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

A BUSINESS of your own—Making Sparkling Glass Name and Number Plates, Checkerboards, Signs. Big Book and Sample free. E. Palmer, 513, Wooster, Ohio.

SELL by mail! Big Profits! Books, Formulas. Novelties, Bargains. Particulars Free! Elfeo, 523 South Dearborn Street, Chicago.

AGENTS—Make a dollar an hour. Sell Mendets, a patent patch for instantly mending leaks in all utensils. Sample package free. Collette Mfg. Co., Dept. 467, Amsterdam, N. Y.

EARN \$10 daily silvering mirrors, plating and refinishing metal ware, headlights, chandeliers, bedsteads. Outfits furnished. F. Dele Laboratories, 1133 Broadway, New York.

MILLIONS stolen. Remarkable new \$5.00 Check Protector stops forgery. Inks, protects two colors. Sensational sales, profits. Write. Safety Devices Corp., Grand Rapids, Mich.

FORMULAS for making your own guaranteed products. Investment Small. No Machinery Needed. 300 to 1200% profit! Stamp Brings Interesting Descriptive Literature for Fly Killing Spray, Delicious Summer Drinks, Best Metal Polishing Cloth, Hair Marcell Liquid, No-Water Hand Soap, Lightning Battery Charging Liquid, Mendit, Fabric Patching Liquid; Amazon Tire Repair, Washing Compounds; Compolith Wood-stone, Wonder Gloss; Wizard Polish; Pure Food; Toilet, Medical, Household Specialties, All lines. State what interests most. Miller, Chemist, 1706 Jettony, Tampa, Florida.

POLMET Polishing Cloth cleans all metal. Sells fast at 25c. Sample free. F. C. Gale, 15 Edinboro St., Boston.

AGENTS—new plan, makes it easy to earn \$50.00 to \$100.00 weekly, selling shirts direct to wearer. No capital or experience needed. Represent a real manufacturer. Write now for free samples. Madison Company, 566 Broadway, New York.

AGENTS! Big money monogramming by transfer method. Catalog showing over 50 styles and particulars free. Motorists' Accessories Co., Mansfield, Ohio.

ANY salesmen can sell them! Merchants everywhere use punchboards. Someone sells them, why not you? Collect big commissions daily. Newest, largest elaborate catalog sent upon request. Lincoln Sales Co., 9 S. Clinton, Chicago, Dept. G.

JUST OUT—strings, straps, hooks, or buttons. On or off in a jiffy. Over 100% profit. Commissions paid daily. Write for free sample offer. [Sta-Put Co. 901 N. 11th St., St. Louis, Mo.

AGENTS—Steady income. Large manufacturer of handkerchiefs and dress goods, etc., wishes representative in each locality. Factory to consumer. Big profits, honest goods. Credit given. Send for particulars. Freeport Mfg. Co., 24 Main St., Brooklyn, N. Y.

AUTO Emblems. Any Lodge. Write. North Central Distributors, Dept. M, Ashland, Ohio.

SELL new and used clothing to general Stores and Tailors. Numerous other new articles. Good pay. Young Co., Dept. P, 2549 So. Halsted, Chicago.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

MANUFACTURER Lamb's Wool, Polishers, Dusters. Newhall, 358 Broad, Lynn, Mass.

AGENTS: Make \$500.00 before Xmas. Pay daily. No investment. Rhinestone Initial Buckles and novelties. Big Xmas and all year sellers. Exclusive territory. Chaton Novelty Co., 606 Blue Island, Chicago.

PROFITS 100% selling quality guaranteed perfumes and toilet preparations that produce permanent repeat sales. Liberal free goods. LeMaire Perfume Co., 3330 Carroll Ave., Chicago, Ill., Dept. 79.

AGENTS for well known automobile polish—full or part time basis. Experience not necessary. Ambitious man, willing to work, can make real money on this proposition. Big commission allowed. A real opportunity for the right man. Barthel Laboratories, 4350 Webster Ave., N. Y.

SALESMEN to sell all wool, hand tailored, made to measure, suits and overcoats \$23.50. Commission \$3.50. large line 6x9 sample swatches, easy to sell. Write for sales plan. Heim Tailoring Company, Department 7, 616 W. Baltimore Street, Baltimore, Md.

FIRE Salvage Rummage Sales. \$50.00 Daily. We start you furnishing everything. Jobbers Desk M14, 1608 So. Halsted, Chicago.

MAGIC Moving Window Salesman. Its real changeable letter system has actually boosted users' sales 200% to 400%. None but dead dealers indifferent. If you can spot a winner, get the facts and begin pocketing \$100 weekly. Display Products Company, P. O. Box H5123, Gateway Station, Kansas City, Mo.

DISCOVERED! Diamond's Rival—Rajah Gems astound Jewelry world and defy detection. Set in artistic Sterling Silver mountings, copies of highest priced platinum designs. Sell like wildfire at popular prices. Salesmen and Agents unique selling plan means enormous profits for you. Write immediately for details. Rajah Company, Dept. Z-1, Salisbury, N. C.

AGENTS—Our gold-eyed needle cases are wonderful sellers; immense profits; \$50 to \$300 weekly; proof and particulars free; sample outfit 15c. Paty Needle Co., Somerville, Mass.

FREE Adding Machine to "Live-Wires" accepting our Dollar-a-Minute Agency. Improved 2-lb. Calculator. Adds, Subtracts, Multiplies, Divides. Work equals \$300 machines. Retail \$15.00. Big demand; large profits. Write quick for protected territory. Lightning Calculator Co., Dept. F, Grand Rapids, Mich.

AMAZING new invention, duplicates anything type-written, handwritten, drawn, ruled. Inexpensive, easily operated. Salesmen coining money. Write free sample offer today! Stenograph, 1271 California, San Francisco.

WE PAY \$48 a week, furnish auto and expenses to introduce our Soap and Washing Powder. Buss-Beach Company, Dept. A48, Chippewa Falls, Wisc.

### Salesmen and Agents Wanted

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

DON'T waste time on specialties. We can show you bigger profits, better values and permanent repeat business. \$750 a month is one man's income. No capital or experience needed. Write quick. American Products Co., 9023 Monmouth, Cincinnati, Ohio.

AGENTS: \$10.75 daily (in advance), spare time will do. Introduce 12 months' Guaranteed Hosiery, 47 styles, 39 colors, for Men, Women, Children; including latest "Silk to the Top" Ladies' Hosiery. No capital or experience needed. We furnish samples. Silk hose for your own use free. New plan. Macoshee Hosiery Company, Road 1521, Cincinnati, Ohio.

MAKE much money—making and selling your own goods. Formulas by experts. Manufacturing processes. Trade secrets. All lines. All kinds. Catalog, special circulars free. C. Thaxly Co., Washington, D. C.

GREATEST MONEY MAKER today. Side line or full time. "Sure-hold" the screw driver with mechanical fingers that start the screws, bolt or nut where human fingers cannot reach. Every mechanic buys on sight. No competition. Sells for \$3.35 per set (3 sizes). Just show it and collect. Millions will be sold. Salesmen calling on auto repair and battery service stations, electricians, plumbers, furniture and cabinet manufacturers, piano tuners, store manufacturers, etc. can increase their income \$50 per week. We Guarantee the Sale. Upon receipt of \$2.35 we will send you sample set and full particulars showing you how to make \$100 per week. Positively—not maybe. If you are not delighted with our proposition, return the "Sure-Holds" and we will immediately return your money. If you prefer, send 50 cents postage and pay postman \$2.00 upon receipt of set. Exclusive territory rights now being granted. If you qualify, we give you an Automobile free. Be first. References, Seattle National Bank, Sure-Hold Screw Driver Co., Third and Jefferson, Dept. E. M., Seattle, Washington.

"THE ROAD to fortune"—Marvelous New Book, just published. Hundreds of Spare-Time Money-Making Ways. \$2.75 postpaid. Price advanced January 1st. Circular free. Colonial Mail Order Co., Box 369, Morristown, New Jersey.

WANTED—County agents to market 3A garage Door Holders. Their Simple Automatic Action instantly attracts Private Garage Owners, Builders, etc. Write for attractive proposition. Knowlson-Stevenson Company, Ann Arbor, Michigan.

SALESMEN—Here is a Winner. Patent just out. Sell to Eating houses. No competition Shook Mfg. Co., Waterloo, Iowa.

MIRRORS resilvered at home. Costs less 5 cents per square foot; you charge 75 cents Immense profits, plating autops, reflectors, tableware, stoves. Refinishing metalware, etc., outfits furnished. Details free. Write Sprinkle, Plater, 96, Marion, Indiana.

AGENTS wanted to handle a new invention for automobiles. Selling like wildfire. Splendid side line. Address Prest-O-Valve Co., Honesdale, Pa.

GENERAL agents wanted to sell post cards through our original Trust Scheme method. No talking required. Big profits. Sample and selling plan, 10c. Roane Service, 1243 So. 22d St., 2d fl., Philadelphia, Pa.

SEEK NO LONGER! Become independent! Be your own boss! Become my representative. Introduce sensational 3 in 1 Hot Water Bottle Combination. Startling invention. Every home buys. \$20.00 daily easily earned. No capital needed. I furnish everything. Write for great surprise. President Lobl Mfg., Dept., C1-12, Middleboro, Mass.

ARE you old at forty? See our advertisement on page 124 of this issue. The Electro Thermal Company, 4065 Main Street, Steubenville, Ohio.

AGENTS—\$15.00 daily easy with amazing fluid. Mends hosiery, dresses, and 1000 other articles in few seconds. 50% to 200% profit. Free outfit. New-Way Laboratories, Desk E-4, Mt. Healthy, Ohio.

THE Big Season is on; start now. Supreme Shirts give 100 percent satisfaction. Proposition and Kit Free. Supreme Shirt Co., 276-F Fifth Ave., New York.

SELL La France Excursions. Big commissions and free trip to Europe. C. Delogastia, 228 Washington St., New York.

### Shop Equipment

TIRE AND BATTERY Shop Equipment at wholesale. Send for Circular 130. Adams-Barre, Columbus, Ohio.

### Stammering

ST-TUT-T-T-FERING and stammering cured at home. Instructive booklet free. Walter McDonald, 59 Arcade, 1126 Granville Avenue, Chicago, Ill.

### Stamps and Coins

STAMPS, 100. All different, 3 cents. Lists free. P. S. Quaker Stamp Co., Toledo, Ohio.

STAMPS Free—Ask for money-saving approvals. John K. Borresen, Cedar Falls, Iowa.

STAMP Collectors—Phillips Monthly Bulletin (illustrated) offers over 2000 special bargains, sets, packets, etc. each issue. Free. Phillips, Box 1012, Hartford, Conn.

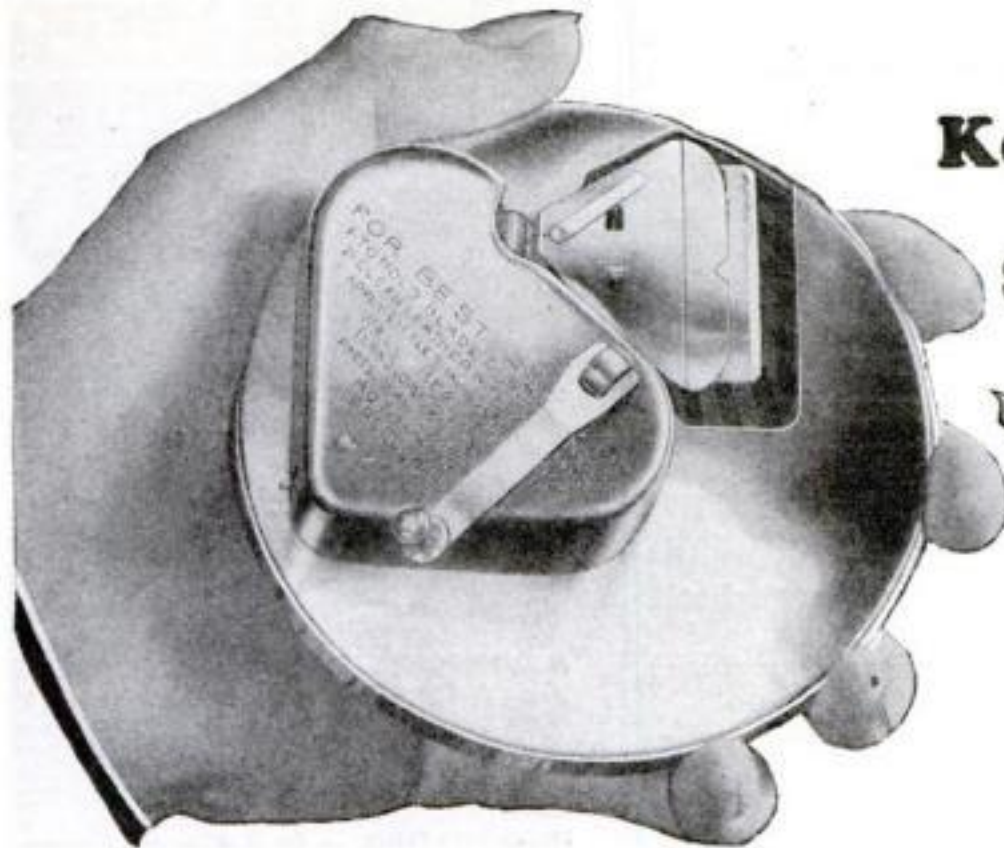
STAMPS, 105 China, etc., 2c. Album (500 illustrations) 3c. Bullard, Station AA, Boston.

OLD coins, large Fall selling catalogue of coins for sale free. Catalogue quoting prices paid for coins, ten cents. William Hesslein, 101B Tremont Street, Boston, Mass.

FREE! 12 scarce Azerbaijan to approval applicants. Mammoth Illustrated Price List 2c. Pennsylvania Stamp Co., Greensburg, Pa.

CALIFORNIA gold 3/4 size, 27c.; 5/8 size, 53c. White cent and catalogue, 10c. Norman Schultz, Box 746, Salt Lake City, Utah.





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Keen Shaves  
With The  
Same Blade



# Amazing Invention Revolutionizes Shaving

Surprising New Invention Upsets All Established Shaving Traditions And Methods. Makes Any Kind Of Safety Razor Blade Last For Months And Even YEARS. Gives You The Keenest, Slickest Shaves Of Your Life And Cuts Shaving Costs 83%. Special FREE Introductory Offer. Act At Once!

## No More Blades to Buy!

HERE is the most remarkable invention in the history of shaving. It marks such a radical advance in new shaving comfort and economy that it deserves to be called much more than a stropper. KRISS-KROSS is a super stropper—a blade rejuvenator. Almost literally, it makes a new blade out of an old one every day—makes hundreds of keen, quick shaves blossom where only one grew before. Until you've seen KRISS-KROSS—fitted its sturdy, nicked smoothness into the palm of your hand, and tested its uncanny ingenuity, you'll never know how really sensational this announcement is!

### Magie Diagonal Stroke

KRISS-KROSS employs the diagonal stroke, same as a barber uses. Never before has anyone captured the secret of successfully reproducing this stroke automatically. Eight "lucky leather grooves" do the trick in 11 seconds with a precision it takes a master barber years to attain. Human beings have their off-days, but KRISS-KROSS is on the job with unvarying accuracy 7 days a week and 52 weeks a year!

But that's not all. KRISS-KROSS embodies still another feature that has hitherto baffled mechanical reproduction. It stropps from heavy to light. It's absolutely uncanny the way the strokes start with strong pressure and grow lighter and lighter until an adjustable automatic jig

flies up and notifies you that your blade is ready—ready with the keenest cutting-edge that steel can take!

### 365 Shaves A Year From One Blade

No wonder that this super-stropper prolongs the life of any make blade—single or double edge—for weeks, months and years! No more bother about remembering to buy new blades! No more "raking" with dull ones! No more stinging and smarting that has to be relieved with messy lotions and harsh astringents! Now you can gallop through your daily shave with lightning speed. Eleven seconds with KRISS-KROSS and your blade has the slickest, keenest edge that ever said "Good Morning" to your chin. And you "twice over" fellows are going to find that once-over does the trick. KRISS-KROSS solves your blade problem for all time. Keen, velvet-smooth shaves forever. And think of the economy!

### Sensational Offer

And now, for my surprising offer. To introduce KRISS-KROSS to those who have not yet seen it, I am giving with it free a new kind of

razor. Possesses remarkable features. Instantly adjustable to any shaving position. A flip of the finger makes it (1) T-shape; (2) straight (old style),

(3) or diagonal (new way). Gives a sliding instead of pulling stroke. Simply zips right through the toughest crops of whiskers and leaves your face satin-smooth and cool, with none of that "spanked" after-feeling. Made of rustless metal. All one connected piece—nothing to assemble or screw up. Entirely unlike anything you ever saw before.

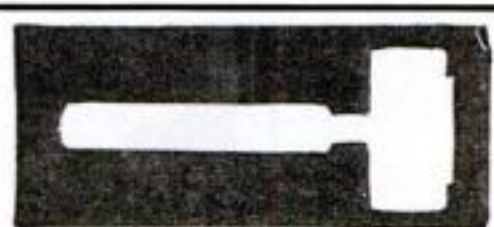
This remarkable razor comes free with 5 special-process blades which, stropped with KRISS-KROSS stropper, should last you from five years to a lifetime, without exaggeration. J. M. Starkbury of Oklahoma writes that he has used only one blade since purchasing KRISS-KROSS a year ago. W. D. Carroll of Pennsylvania has had over 2 years' shaves from wornout blade and still going strong! Hundreds of others report 1, 2 and 3 years of keen shaves from the same blade! Really astonishing!

### Get Free Offer

Send for full information on these surprising new inventions today. KRISS-KROSS products are never sold in stores. You deal direct with me or my authorized representative. Write for illustrated description and full details of free razor offer. It's even more remarkable than I can tell you in this short space. Clip the coupon now. Mail it today.

### AGENTS MANY EARN \$150 A WEEK AND UP

Make big money with KRISS-KROSS. Giving away FREE razors boosts your profits amazingly. H. King made \$60 in one day. N. C. Paige made \$104 in 3 days. Others average \$350 and up to \$750 a month. SPARE-TIME workers, OFFICE and FACTORY men make up to \$6 and \$12 extra a day showing KRISS-KROSS to friends and fellow employees. S. Kantala made \$154 extra just working evenings 3 weeks. Get details at once. Check bottom of coupon and mail it tonight.



### Mystery Razor Free To Every User

Most astonishing razor you ever saw. Really 3 razors in one. Adjustable to any shaving position. Novel feature reduces beard resistance 45% and simply zips through the toughest crop of whiskers. Nothing like it ever on the market before. I'll send you one FREE to introduce KRISS-KROSS super-stropper. Limited offer. Find out about it today.

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**Rhodes Manufacturing Company STROPPER**

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Rhodes Mfg. Co., Ind., Dept. A-241,  
1418 Pendleton Ave., St. Louis, Mo.

Without obligation, please send me illustrated description and full details of your special introductory offer on KRISS-KROSS super-stropper and FREE 3-way razor.

Name.....

Address.....

Town.....State.....

( ) Check here if interested in making money as authorized KRISS-KROSS representative.



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Get all the particulars about this wonderful Auto Home Training which includes all Electrical work—all Mechanical work—also Life-time Employment Service, Consultation Service and 4 Big Working Outfits included Free of extra charge.

**CLIP COUPON NOW!**

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Includes Tools, Tool Bag, Electrical Test Bench, Also 308 Wiring Diagram Charts, Also Special Electrical Outfit.

### Stamps and Coins

STAMP packet 2c to Approval Applicants. Harvey Teeple, Decatur, Indiana.

UNITED STATES and Foreign Coins. Military Decorations. Catalogue and 500,000 mark bill, 10 cents. Alexis Mengelle, Colorado Springs, Colorado.

CURIOSITY and catalogue—10c. Dime Information Bureau, Colorado Springs, Colorado.

500 DIFFERENT 28c, 1000—85c, 2000—\$2.95, None better. Refund guarantee. R. Benno, Glen Ellyn, Ill.

SPECIAL Newfoundland Catalogue. Every stamp illustrated. Send 10c for a copy. Will credit you this on your first order. Try these—38 Nfld. postage, all different face (Cat. \$5), for \$1. Rev. Butler, St. Georges, Newfoundland.

100 DIFFERENT and bargain list, 4c. Walter Oliver, Williamsville, N. Y.

150 GOOD mixed foreign stamps, 3c. Stanton (144), Niantic, Conn.

300—300—300. ALL different stamps (cat. over \$6.00); 300 hinges; 5 approval sheets; duplicate stamp album; perforation gauge; millimeter scale and ruler to approval applicants only for 20c. Edgewood Stamp Co., Dept. 8., Milford, Conn.

1,000 MIXED U. S. and Foreign Stamps, 25c. Phil Lundsted, Cape Cottage, Maine.

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### Typewriters and Supplies

TYPEWRITERS: all makes; lowest prices; 5 year guarantee; send for illustrated catalogue. Henry Typewriter Co., 217 West 125 Street, New York, N. Y.

"RENT a typewriter." Any make. If you pay its price in rent, we give machine free. Catalog free. Pab. Typewriter Supply. Suite 543, 339 Fifth Ave., Pittsburgh, Pa.

TYPEWRITERS, all standard makes, thoroughly remanufactured by the famous "Young Process" and shipped direct from factory to you on 10 days' trial. Guaranteed 5 years. Easy monthly payments. Write today for free catalog. Young Typewriter Company, Dept. 5761, 654 W. Randolph St., Chicago.

### Wanted

DETECTIVES needed everywhere. Experience unnecessary. Particulars free. Write, George Wagner, former Government Detective, 1968 Broadway, N. Y.

WANTED—Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.

## A Test Every Man Past 40 Should Make

Medical authorities agree that 65 % of all men past middle age (many much younger) are afflicted with a disorder of the prostate gland. Aches in feet, legs and back, sciatic pains, are some of the signs—and now, a well known American scientist has written a remarkably interesting Free Book that tells of other symptoms and just what they mean. No longer should a man approaching or past the prime of life be content to regard these pains and conditions as inevitable signs of approaching age. Already more than 20,000 men have used the amazing method described in this book to restore their youthful health and vigor—and to restore the prostate gland to its proper functioning. Send immediately for this book. If you will mail your request to the Electro Thermal Company, 4035 Main Street, Steubenville, Ohio—the concern that is distributing this book for the author—it will be sent to you absolutely free, without obligation. Simply send name and address. But don't delay, for the edition of this book is limited. Western Office, Suite 40-H, 303 Van Nuys Bldg., Los Angeles, Calif.

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Advice for Popular Science readers regarding safe and profitable investments. See page 4.

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Be a Motion Picture Cameraman, Portrait, News or Commercial Photographer. Big money in all branches. Hundreds of positions now open pay \$75 to \$250 a week. Easy, fascinating work.

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NOTE: If you prefer to come to one of our studios for instruction write for Catalog R-5, to nearest address: 10 West 33rd St., New York City, or 630 S. Wabash Ave., Chicago.





## How the Movie Camera Lies

(Continued from page 17)

feet away, recorded was a stirring picture of a battle fleet in action, realistic enough to bring patriotic hysteria to the thousands of potential Navy recruits who thought they were seeing the actual engagement. This identical method is still in use—for depicting floods, fires, shipwrecks and similar catastrophes where the destruction of actual houses and ships is too costly even for the movies.

Who said the camera never lies? You know that a picture of two friends shaking hands will, if the finisher has printed the film wrong side up, show them with their left hands clasped.

IN "THE Ten Commandments," the waters of the Red Sea were seen to part to let the fleeing Israelites pass through—only to close in a gushing cataract upon the pursuing armies of Pharaoh. This spectacle was obtained by double exposure. A part of the picture, later to contain the fleeing tribes, was blocked off. Then a scene was made showing water rushing into a glass-sided trough from the sides above. Two records were made of this, the first with the camera cranked backward. This represented the parting of the waters; and the other, their closing again. Now the film was again exposed, this time with the water scenes blocked out, and the armies marching on dry land; as well they might, for there was no water anywhere near them.

A comedian walks rapidly across the scene. You can see he is in a tremendous hurry, for his feet are moving as if he were on a spinning treadmill. So he was. A black velvet drape concealed the background when the treadmill effect was filmed, and the finished background—a street scene shot from a rapidly moving automobile—later substituted. This type of combination picture requires no great skill, for the fast motion obscures the faking.

A GREAT deal more difficult is the process that enables actors to double for themselves in a picture that may contain two characters of mutual resemblance; when, for instance, an actress appears in the same scene as mother and daughter. "But I know how that's done," you say. "They take half the picture at a time, and each character stays on one side of the picture." True, and right you are. But suppose they don't? Suppose mother and daughter meet in the center of the picture for a fond embrace? That happened in a recent picture.

The answer, as in most clever illusions, is simple enough. At the moment of the embrace, the camera was stopped and another actress was put in to take the place of one of the characters. She kept her back to the camera and the few moments of action did not leave time for the artifice to be discovered.

As mentioned before, the camera has no sense of distance. The effect of nearness or of farness depends entirely on the ordinary effect of perspective. If you see on the screen one big house and one tiny one, your

(Continued on page 126)



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It's just as I said or It's just like I said  
The river has over- or The river has over-  
flowed its banks flown its banks  
I would like to go or I should like to go  
I laid down to rest or I lay down to rest  
Divide it among the three or Divide it between the three  
The wind blows cold or The wind blows coldly  
You will find only one or You will only find one
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hospitable hos-pi-ta-ble or hos-pit-able  
abdomen ab-do-men or ab-do-men  
mayorality may-or-al-ty or may-or-al-ty  
amenable a-me-na-ble or a-men-able  
acclimate ac-cli-mate or ac-cli-mate  
profound pro-found or pro-found  
beneficiary ben-e-fi-sh-ary or ben-e-fish-ary  
culinary cul-i-na-ry or culi-na-ry
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date  
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## How the Movie Camera Lies

(Continued from page 125)

senses will tell you that, most likely, the big one is near and the little one a long way off. An ingenious bit of trickery was recently based on this fact. It was desired to give the illusion of great length to a vaulted corridor on a set, which consisted of a short row of arches with costumed guards at each. These guards were so chosen that the man at the first arch was of magnificent stature; the next one not quite so large; and so on down to the last, who was a small boy. Moreover, the arches themselves were made successively smaller as the distance from the camera increased. The completed picture showed a corridor of impressive length vanishing into the background.

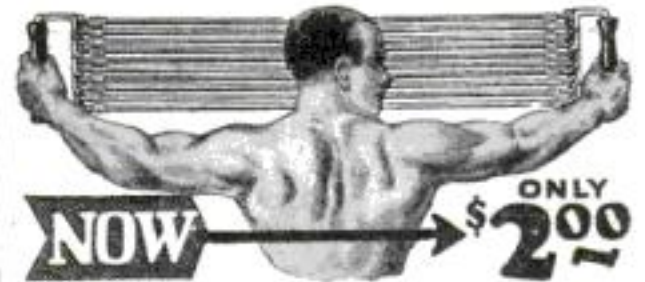
Difficult trick photography was called for in the making of "The Bells," in which Lionel Barrymore appears. Director James Young wanted two weird scenes. One was to show a murderer counting his spoils. Suddenly blood was to appear in his hands, then slowly fade out, as a symbol of his tortured conscience. The second scene that Young asked L. William O'Connell, the cameraman, to work out, was to be a game of cards played by Barrymore and a ghost. Double exposure was barred.

FOR the first action, O'Connell splashed the murderer's hands with red ink. The scene began in the slight dimness of a reddish light. Then a blue spot light cut through the air to the hands of the murderer, and sharply the red spot stood in relief. The spot light gradually faded out, and again there was only a subdued red light. In the black-and-white picture the stains were mysteriously seen to flash out, then slowly disappear.

The ghost scene was more complicated. The ghost must be shadowy in substance, but the cards he held must be real. O'Connell solved the problem in a masterful way. At the back of the set was the card table. Barrymore sat at the near side, his back to the camera. Opposite him, on the far side, a mirror faced the lens. The camera was so situated that it received light reaching the mirror from offstage. In a dim light in the wings sat the "ghost," the faint illumination making his reflected image in the mirror seem unearthly indeed.

THE cards he held were painted a glaring white. In ordinary stage make-up, white is barred as too brilliant, and yellowish make-up is used to tone down the white skin of an actor. But in the half-light offstage, the brilliant cards offset the dim lighting and appeared real, while the ghost's form remained indistinct. What the audience saw was a creepy thriller showing a human being playing cards with a spirit.

They make mighty good entertainment, these films. But don't forget to take them with an occasional grain of salt. If you can't believe your own eyes—and who can in this day and age?—how much less can you put any faith in a camera!



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## Atomic Bullets Open New Worlds

(Continued from page 13)

ask, can these electrons get out through a window of metal that is dense enough to hold back the air from outside the tube? The answer is that the electrons are so much smaller than the atoms of which the window is made that they can dodge between them. The atoms of air, on the other hand, are too large to squeeze through into the tube.

The magical and startling transformations that occur in various objects which come in the path of the cathode rays are produced, we are told, by the terrific impact of the flying electrons against the atoms of matter subjected to them. This impact upsets the balanced arrangement of positive and negative charges within the atoms, and so literally changes the substance of which these atoms are units.

FOR example, the atoms of gases in the air about the window of the cathode ray tube become ionized, or positively charged. The result, to human eyes, is the strange ball of purple glow which appears before the window.

Again, in the crystal of calcite which glows orange in the path of the rays, numerous bluish-white sparks can be seen beneath the surface of the crystal. These are believed to be electrical explosions, the result of the bombardment of electrons. Thus it is, too, that granite, which is a mixture of several minerals, glows with several different colors.

While no one now can predict what wonders, if any, the cathode ray tube will provide in the way of future usefulness, the experiments already made suggest fascinating possibilities. If, for example, as the first demonstrations seem to indicate, the rays are capable of coating metal with a tough, lacquerlike film which not even the strongest acids can penetrate, this alone would make the invention of inestimable practical value.

AGAIN, since the rays are known to kill insects and germs almost instantly, it may be that the new tube will provide a new weapon against disease. Treatment of skin afflictions, too, is suggested by experiments with rabbits. In one experiment, a small part of a rabbit's ear, about the size of a dime, was exposed to the rays for a second. A scab formed and fell off, taking the hair with it. Two weeks later there appeared a heavy new growth of snow-white hair.

As yet Dr. Coolidge has not attempted to develop any practical application of the vast power he has unleashed. He is still at work to improve his tube and to develop cathode rays of even greater intensity and quantity. He tells us that eventually it may be possible to increase the electrical pressure which produces the bombardment of electrons from the present 250,000 volts to 2,000,000 volts.

Finally, he assures us that this is in no sense an instrument of destruction. Cathode rays, he says, never can be "death rays" for use in warfare, for the very good reason that their longest range probably never will exceed five feet.



## How You Catch Colds

(Continued from page 24)

You have only to shampoo your hair and leave it wet for a time to experience enough stuffiness in your nose to make it necessary to breathe through your mouth. Riding in an open trolley on a windy night without a coat or walking through melting snow without galoshes may cause the same discomfort. But mostly this nasal tightness is not deserving of the name of a cold. It lasts only a short time, after which the nose is as healthy as ever before.

**T**HE probability is that exposure to cold, dampness and drafts does play a rôle in the onset of a cold, but only a subsidiary one. Cold and wet applied to the body, it has been shown, diminish the amount of blood supplied to the nose. And a diminished blood supply means less resistance to microbes. Thus whatever part exposure plays in causing coryza partakes of the nature of preparing the nose for the invasion of the germs, rather than of causing the cold itself.

Hot drinks and hot mustard foot baths are familiar old-fashioned remedies for colds, and undoubtedly their popularity is deserved. Sweating is a time-honored remedy, and is quite effectively induced, also, by hot lemonade and scorching hot baths. To these esteemed treatments we may add steam, medicated with turpentine or compound tincture of benzoin, inhaled through the nose and brought directly to the seat of the disturbance.

The proper thing to do for a cold of any degree of severity may be expressed pithily in three sentences: Stay home. Stay in bed. Send for the doctor. The person who obeys these instructions will not be guilty of spreading his microbes all over his fellow men and will, at the same time, be doing his best to avert serious complications in his own case.

## The Captain's Car

(Continued from page 62)

just removed. "Look, it's full of dirt and the dirt interfered with the flow of gasoline. I'll clean it out and the one on the vacuum tank, and then blowout the gasoline pipe with compressed air. She'll run fine after that."

But the motor refused to start. In fact, the young repair man wasn't able to get a single explosion out of it.

"That's strange," he said. "Maybe it's one of the valves. I'll look 'em over." And he took off the plates that covered the push rods. While the captain pressed the starter pedal, the young man watched the valves carefully. They moved up and down perfectly. A test of the compression was his next step.

"The compression doesn't amount to much," he observed, turning the motor over by hand a few times. "Still, I never saw a motor stop just because the compression was a little weak. It's just as good in one cylinder as another, too."

By this time the young man had lost his swaggering assurance. "It's got me licked," he confessed humbly . . .

*What was wrong with the captain's car?*

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## The Power of Music

(Continued from page 20)

tune like "Old Black Joe" or "Suwanee River" and play it in quick-step time! I recall vividly a young organist in a small town church in New Jersey who, at the close of the mid-week prayer meeting, after the departure of the congregation and elders, would open the hymnal to the slowest hymn he could find and dash it off in high-speed syn-copation. Soon he would have the members of the choir, who had remained for practice, dancing through the aisles.

IT IS rhythm that is giving music a definite job today in industry. Jess Hawley, the noted Dartmouth football coach, explained recently in POPULAR SCIENCE MONTHLY how rhythm boosts the power of his eleven by promoting unity of action, or teamwork. Similarly the rhythm of music is being put to work in factories, offices, schools and workshops, especially where the work requires constant repetition. Music not only speeds up the work but keeps the workers happier and healthier. In the plant of a large electrical manufacturing company at Newark, N. J., music noticeably increased the efficiency of the workers engaged in sorting machine parts.

Factory music has led to many interesting discoveries. For one thing, where machinery is operating with definite rhythm, the music must follow the rhythm of the machines; otherwise it may do more harm than good, possibly causing an accident. The reason is that the human body cannot do teamwork under the influence of more than one rhythm at a time.

A recent incident in a Michigan factory illustrates the importance of this. A certain punch press seemed to possess the uncanny faculty of injuring the hands of every man who tried to operate it. At last a consulting engineer was called in. He discovered that the sound made by the machine was of a different rhythm from that of the machine's operation, resulting in confusion to the operator. A slight adjustment changed the sound rhythm and remedied the difficulty.

IN medical treatment also, music is now a recognized aid to physicians. It cheers patients and relieves pain; it infuses new energy in those who need stimulation, and calms others who are over-excited. In New York City alone some fifteen hospitals have introduced music under scientific supervision. Hospitals throughout the country have installed radio sets, talking machines and piano players. Musicians are being trained to cooperate with physicians.

In this field, too, it has been learned that music must be selected with care. An intensive study of the subject has just been completed by Dr. James Ewing of Cornell University, noted authority on cancer treatment, among his patients in the New York Memorial Hospital. He made many measurements of pulse, temperature, respiration and blood pressure among patients under musical influence.

The results (Continued on page 131)



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## The Power of Music

(Continued from page 130)

proved that the kind of music which may benefit one patient may injure another. For example, a brilliant selection was found dangerous to a patient with high blood pressure, whereas it stimulated another patient with low vitality. Pleasing music of moderate rhythm, however, played for short periods at a time, was found generally beneficial to nearly all patients.

**M**ANY instances have been reported where music has been employed to relieve pain and to aid as an anaesthetic. At the Providence Hospital in Washington, D. C., phonographic music is played softly in the operating room to soothe the subconscious mind of the patient under anaesthetic. In Chicago not long ago an operation was performed on a patient's eye without any anaesthetic. Instead, a violinist played continuously during the half hour of the operation. At the conclusion the patient said that she "felt no pain and the music was beautiful."

Again, Dr. W. E. Dentiger, a Connecticut practitioner, declared not long ago that Vice-President Charles G. Dawes, when he wrote his "Melody in A," provided "just the thing for hysteria." And Schubert, he added, when he composed the immortal "Serenade" conceived a blessing for the insomnia patient.

Undoubtedly other factors beside rhythm have a part in giving music its power. Among them are the loudness, or volume of the sound; the pitch, determined by the rate of the sound vibrations; the timbre, or tone quality; the tempo, or characteristic movement; accent, cadence, harmony, and so on.

Many of us have had the experience of being "raised off our seats" by the very intensity of musical sound. Caruso, so the story goes, could strike a drinking glass, repeat its note with his voice, and continue to sing that note until the intensity of vibrations shattered the glass. Is it any wonder, then, that some blasts of music can send shivers down our spines?

**A**S FOR pitch, we know that certain tones are more pleasing than others and that some are decidedly disagreeable. A woman's piercing scream, the shriek of car wheels, the hiss of the villain—all are sounds that "hurt" our ear or affect us unpleasantly, because their vibration frequency is higher than our ears like to hear. On the other hand, low rumbling organ tones are displeasing to many people.

To get the whole story of music, as was suggested the other day by Prof. Michael I. Pupin, of Columbia University, "we must follow the sound vibrations through that marvelous receiving instrument, the ear, which with its sixty thousand parts speeds the message along myriads of tiny nerves to the central station, the brain. There the soul of man interprets the language of music."

Perhaps, when we understand this language more fully, we shall find undreamed of uses for the vast streams of music which fill the air and which most of us now regard as little more than passing pleasure.

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## He Speeded Up the World

(Continued from page 32)

"I can't buy you out, and you know it," replied Westinghouse hotly. "What next?"

"Then," coming to the real point, "we propose that you retire."

"And what do you offer for my patents?"

"Nothing!" retorted the other. "We take the patents in return for our capital."

"You do not!" shouted George, snatching up his hat. "I'm through with you and the business! But remember," he was standing in the door now, "if you use my patents, I'll collect every cent coming to me!"

With that he slammed the door behind him and rushed out into the rain. He was without a job, without money, even without a home for his young bride.

THE acts of George Westinghouse were always characterized by resourcefulness and imagination. He at once went to Pittsburgh, where he made arrangements with Anderson & Cook, a steel concern, to manufacture his replacement frog. He was hired by them as a traveling salesman. It was while inquiring his way to the plant that he became acquainted with Ralph Baggaley, general manager of a foundry there. They became warm friends.

In the meantime Westinghouse had filed his application in Washington for a patent on his air brake, and he now proceeded to present his drawings to every railroad executive whom he encountered.

Its reception was discouraging. One officer would listen attentively, agree with everything, and return the verdict, "Not interested." Another would be too busy to hear the full explanation. Others were more amused than concerned. Cornelius Vanderbilt heard the whole thing through, but in his blunt manner pronounced the air brake "visionary," not worth the time and money for investigation.

Upon Baggaley's suggestion, when he confided in him his dream, Westinghouse wrote to his father for money to give the brake a trial. But the older Westinghouse refused flatly. It was also on Baggaley's instigation that the plans of the air brake were submitted to an expert for his opinion. The expert pronounced the project ridiculous and utterly hopeless.

"WELL, what are we going to do about it?" asked Westinghouse.

"Just this," answered Baggaley, and he tore the report into bits, hurled them into the grate, and watched the flames curl about them. "From now on we stop wasting time with paper plans and get to work on an actual model of the brake that can be tested by the first one who will give us a chance to test it."

So, with Baggaley's backing, Westinghouse built his machine as carefully as if all the railroads in the country were waiting to equip their trains with it. The mechanism complete, he again approached the railroad officers, and again he found only discouragement. They already had brakes that seemed to them as satisfactory as need be, and a trial of the new one would be expensive. (Continued on page 133)

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## He Speeded Up the World

(Continued from page 132)

Thus it fared until the fall of 1868. Then Robert Pitcairn of the Pennsylvania Railroad looked at the brake, had his superintendent examine it, who in turn brought Andrew J. Cassatt. They became enthusiastic. They were willing to furnish a train—but—could the inventor bear the expense of a demonstration? The inventor could not. Well, then, the railroad men would have to deliberate further. All was gloomy again.

And then, when the spirits of the young men were lowest, came W. W. Card of the Panhandle.

"I have heard," he announced, "that you have invented a wonderful brake."

**WESTINGHOUSE** nearly fainted. So used was he to the evasions and suave courtesy of railroad managers that he could scarcely comprehend this straightforward manner. Card meant business. He had faith in the invention, and he tried to convince his company that it should make a test at its own expense. The best he could do, however, was to get an order from the president for a train to be used by Westinghouse for an experimental trip.

The offer was virtually the same as Pitcairn's, but Westinghouse and Baggage accepted rather than delay any longer.

The train assigned them was soon equipped, for the apparatus itself was already built. The morning of the trial arrived. Four cars had been hitched behind the locomotive. In the fourth rode officers of the company and others invited.

The demonstration train drew out of the Panhandle station and passed slowly through a tunnel. Then Tate, the engineer, increased the speed to about thirty miles an hour. Arrangements had been made to keep the crossings clear until the trial train had passed; so Tate turned to the mechanism for another inspection. In the instant that his eyes left the road a truckman, thinking that he could beat the engine to the crossing ahead, made a wild dash for the tracks. Tate's eyes returned to the road just as the frightened horses plunged madly and the driver was hurled in the path of the speeding train.

**TATE** grasped the brake control and twisted insanely. With a mighty lurch the train stopped dead.

Picking themselves from the floor, the passengers in the rear car scrambled to the platforms and sprang to the ground. They found Tate assisting the terror-stricken truckman to arise—four feet from the cowcatcher.

So bruised and ruffled were the witnesses, that the significance of the event was slow in dawning. And then they comprehended. In saving a human life, the air brake had demonstrated its own efficiency!

Although George Westinghouse patented over 400 inventions before he died, his fame will always rest on the air brake. That was the foundation for the life of great achievement which followed—for it was through his vision, too, that alternating current, which gave us cheap electricity, was developed.

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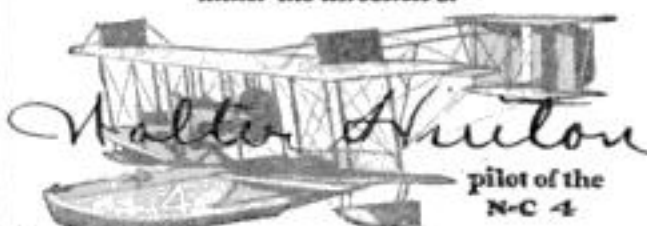
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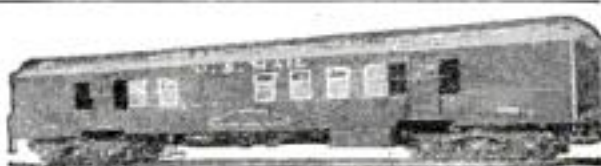
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## Wanted—A New Calendar

(Continued from page 34)

requirement of a calendar than accuracy, it would work pretty well. Where it falls down, however, is in the confusion it causes in modern business transactions.

As Professor Marvin points out, statistical comparisons from month to month are almost useless under the present system. The difference between February's twenty-four business days and March's twenty-seven is twelve and one half percent. But sometimes February has twenty-five business days and March has five Sundays, leaving only twenty-six business days, reducing the difference to only four percent.

IF THERE were no other considerations, the thirteen-month year, with its four even weeks in each month and a *dies non* or intercalary day thrown in to make it balance, would be ideal. The man on a monthly salary would give no more time for his pay in March, with no holidays, than he did in February, with Washington's and Lincoln's birthdays. As it is now, he does twenty-three days' work in February and costs his employer as much as he does for twenty-seven days in March. Beginning every month's business operations on Monday and ending them on Saturday would make daily, weekly and monthly comparisons and forecasts extremely simple.

In Europe, however, there are objections to the Marvin idea. For one thing, the Europeans do many things on a quarterly basis which we in America do on a monthly basis. In England, for example, rents are payable quarterly, at the end of the quarter, instead of monthly in advance as here. Wholesale and retail credits in Europe are generally on a semi-annual or quarterly basis, and the thirteen-month year won't divide into halves and quarters.

THE League of Nations began in 1921 its movement toward calendar reform. Three conventions have been held, in 1922, 1923 and 1924, of delegates sent by governments, religious organizations and business bodies. More than a hundred schemes for calendar reform have been proposed. Virtually all of the workable ones call for a 364-day calendar, with an extra or intercalary day inserted between the end of one year and the beginning of the next and having no relation to any month. A second extra day is provided for leap years.

Banks and other business organizations seemed to be generally in favor of the intercalary day, for the same reason that they rejected the thirteen-month year. By having one of the 365 days a *dies non* the remaining 364 divide easily into four quarters of ninety-one days, or precisely thirteen weeks each. It was generally agreed that February should have at least thirty days, and all were in favor of retaining January 1 as New Year and making no change in the numbering of the years according to the Christian scheme. That Easter should be fixed for the first Sunday in April, making seven days the widest possible variation in its date, (Continued on page 135)

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## Wanted—A New Calendar

(Continued from page 134)

instead of thirty-five, was the consensus of opinion.

There the matter rests, so far as the League of Nations is concerned, but two extremely significant events indicate that the League has started something. One of these was the calling by the Pope of a conference of astronomers to consider the possibility of reform, especially with regard to a fixed date for Easter. The other was the action of the Greek Catholic Church, which pitched the ancient Julian calendar into the trash pile!

THAT happened at a meeting in Constantinople in May, 1923, at which all of the orthodox Oriental Christian churches, including the Russian, Serbian, Greek and Roumanian, were represented. First they agreed to drop out of the year 1923 the thirteen days whereby the Julian Calendar now differs from the Gregorian. What would have been October 1, 1923, in Russia, Roumania and the other eastern European countries, became October 14th, the dates between that and September 30th being nonexistent for that year. Then they adopted the Gregorian leap year schedule, with this modification: The twenty-four to twenty-five seconds by which the Gregorian year differs from the astronomical year are taken care of by making leap years out of century years only when the first two figures of the year, when divided by nine, leave a remainder of either two or six. The new Greek church calendar and the Gregorian calendar will tally precisely up to the year 2800, which will be a leap year under the Gregorian scheme but will have only 365 days in the Greek scheme.

HIGHLY thought of in England is the plan of Alexander Phillips, secretary of the Royal Astronomical Society. He would take the 31st day from August and add it to February, make one day in each year an intercalary holiday, with two in leap year, and stop right there. Every week then would have a definite position in the year—could be numbered or named as the months are; there would be precisely fifty-two weeks in four equal quarters in each year; certain dates could never fall on Sunday—the 4th, 7th, 11th, 14th, 18th, 21st, 25th and 28th.

Another scheme, much favored on the Continent, is the New Era Calendar, devised by Professor L. A. Grosclaude of Geneva, Switzerland, and shown on page 34. This would have the 364 regular days and the extra holiday. Under this calendar a given date would fall always on the same day of the week every year. From the business point of view one great advantage of the New Era Calendar would be that every month would have exactly twenty-six business days, exclusive of holidays.

All of which brings us back to about where we started. Calendar reform is on the way and it may get anywhere or nowhere, but there's unending occupation for those who like to calculate, figuring out how to change the existing system.



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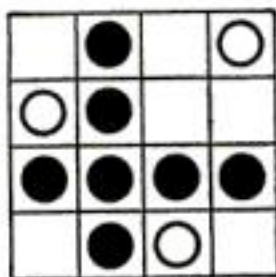
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## Answers to the Sam Loyd Tests on Page 43

### Jumping the Disks

MARKER No. 4 jumps to E, 3 jumps to A, 2 jumps to D, 1 jumps to B, and 5 jumps to C, thus effecting the required formation of ten markers in line. Twenty minutes is fair time to do this trick in your head; ten minutes if you worked with actual markers.



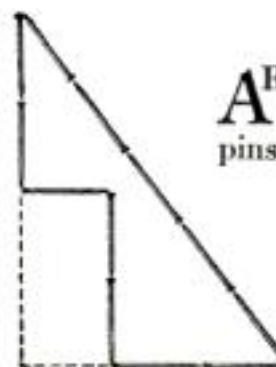
### "Making Rows"

THE open circles illustrate placement of the three checkers to increase the number of rows of even total to sixteen—viewed horizontally, vertically

and diagonally. Ten minutes gives you a high rating.

### A Test of Clear-Headedness

STARTING to the right from A, there are ten varied six-block routes to B. Also, there are ten varied routes with a downward start, so altogether there are twenty different routes between the two points. If you figured this out in fifteen minutes, you earned a high rating.



### "Pins and Areas"

ARRANGED as a right triangle, the twelve pins would inclose an area of six square inches. Turning in three of the corner pins, as shown, cuts two square inches from the area, so the remaining space is

equal to exactly four square inches. Fifteen minutes is a fair time.

### The Palindrome

THE palindrome that can be constructed from the thirteen letters is:

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## Are You Afraid to Face the Truth About Yourself?

There are occasions in the life of every man when he realizes how miserably he has fallen below what others have expected of him and what he had dreamed for himself. The "big" man faces the truth, and does something about it. The "little" man finds an excuse for his failure, and does nothing. What are your answers when you ask yourself questions like these?



Am I not drifting along aimlessly?

What, after all, is my purpose in life?

Am I trusting too much to chance to bring me success?

What is my greatest weak point?

Is it lack of Will, poor memory, mental laziness, mind-wandering, or what?

Am I "licked" by life, am I a "quitter"?

What can I do, now, to "find myself"?

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Don't do it, man—don't do it.

There is no greater tragedy in the world than that of a man who stays in the rut all his life, when with just a little effort he could bring large success within his grasp.

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## Is Your Home Lighted for Beauty and Comfort?

(Continued from page 37)

In the early process, the minute etching cracks tended to weaken the bulb. Then it was discovered that if those cracks were turned into round craters by further etching, the strength of the glass was not impaired. That's the modern method."

"I believe you said that decoration and paper are half the problem of lighting a home," observed Ellen. "Can you give us some details on that?"

"PLENTY. Ceiling tints, for instance, have widely varying color-reflecting values. White gloss reflects the most light, 84 percent, but don't use it, because of its glare. Take white eggshell (81 percent) or white flat (82 percent). Ivory white declines to 79 and cream to 74 percent. White oil paints have been greatly improved in reflecting value in the last decade. Water paints are said to show rapid deterioration, besides being difficult to clean, and are advised only for temporary use."

"What are the values of wall colors?" pursued the young woman.

"This is a tricky question, and even an artist's eye is deceived easily in judging the light values of colors.

"The grays devour a lot of light, while ivory tan returns 67 and buff 55 percent of illumination. Light green returns 63 and light blue 54 percent. Pink has a surprisingly high score of 72 percent. Wall papers that run between pearl and cream reflect about 50 percent of the light thrown upon them, while a dark blue returns only about 20 percent."

"I imagine the dark wood finishes absorb a lot of light, too," said Ellen.

"They do, indeed. Walnut is the worst light thief, taking all but 7 percent, and its nearest accomplice is mahogany at 8 percent, closely followed by dark brown and then by dark oak. A brick color finish absorbs all but 13 percent of the light it receives. A large fireplace of exposed brickwork, therefore, may cut down your living room illumination considerably."

"LOOKS to me as if we could save half our bill by buying light in the form of paint and paper," declared Rob.

"That is generally true," I replied. "However, remember that the best colors fade in time and lose some of their reflecting value. A house must be repainted and decorated every few years."

"Now that we have the house properly painted and papered, what style of fixtures would you advise?" inquired Ellen.

"There are three methods of lighting: direct, indirect and a combination of the two. An example of direct is a hanging lamp with a metal shade that throws the rays directly downward. It is a pioneer method of glare-and-gloom effect that is not suited to most homes.

"Indirect means light thrown entirely upward on the ceiling, from which it is reflected in a soft equal glow throughout the room. This is considered ideal. You do not see the light source at all: the rays are directed up— (Continued on page 139)

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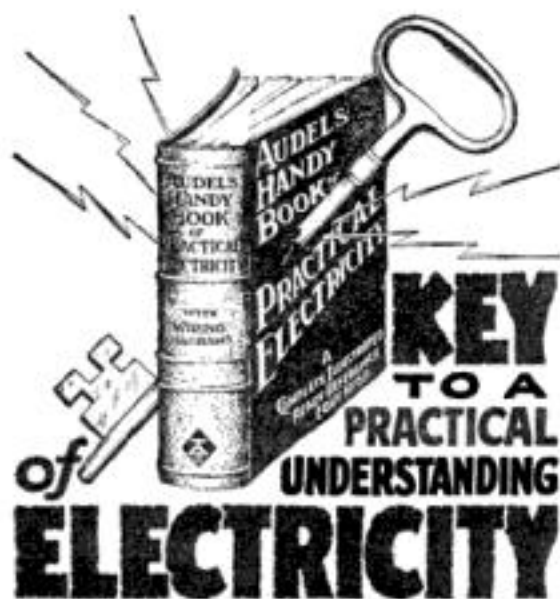
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## Make More Money

Read the Money Making Opportunities on pages 114 to 142 of this issue.





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## Is Your Home Lighted for Beauty and Comfort?

(Continued from page 138)

ward either from a central hanging fixture or from a series of tall floor pedestal lamps."

"THE the third lighting method, which combines direct and indirect, is the most usual practice. It includes reading lamps, wall fixtures and luminaires in which light issues directly downward and is also reflected and diffused upward and around through shades, whether glass, parchment or silk."

"I've noticed that modern homes are doing away with central hanging luminaires," remarked the young woman.

"That is a fashion swing which lighting engineers say is a bad one," I replied. "They think fashion, in this case, doesn't jibe with the mathematical laws of light. For economy and good results, put the main light source at the center, but high enough not to bother the eyes. To equal the center light with wall bracket lamps means more current and more fixtures."

"Is it better to have an open bowl for the center light or the closed kind?"

"If you mean a bowl open at the top, an important thing to consider is its dust-catching proclivities. Between two fixtures of equal merit or attractiveness, always select the one that is easier to keep clean."

"That home lighting table I asked for at first," said persistent Ellen, "isn't there a near-table at least that you can give us?"

"Yes, there is an offhand estimate of average requirements, disregarding paper, paint and room size. Starting with the kitchen, you might install one 100-watt lamp in an enclosed-bowl fixture, up against the ceiling in the center. Half that power might do in a small, light-painted kitchen. The dining room should have at least 100 watts in one or more lamps within a center hanging fixture, shaded to throw the light down on the table. A candelabra center fixture is second choice and may be preferred for looks, especially with harmonizing wall bracket lamps.

"THE living room needs a center light of more power than the dining room outfit and placed higher, so as to spread illumination: say 150 watts in one or more lamps. Add as many table lamps or reading fixtures as you like. They will be used more than the main luminaire, and each one may range from forty to 100 watts in power. For bedroom and bathroom a center lamp of fifty watts is often enough, with the addition of a bed reading lamp and twin bracket lights on either side of the dressing table or shaving mirror.

"Never light a mirror from above or from one side only. For an even job of tinkering a woman's complexion or scraping a man's face, have twenty-five to forty shaded watts on both sides.

"Pilot lights are useful to locate fixtures and to show you your way about in a dark room. One of these small lamps uses the incredibly small current of one twentieth of a watt."



## \$1000 REWARD For the Capture of This Man

CONVICT 6138, escaped from the State Penitentiary; Name, Charles Condray; age 37; Height, 5 ft. 8 in. Weight 141 pounds; Hair, light brown; Eyes, gray.

Easy enough to identify him from his photograph and this description, you may say—but, Condray took the name of "Brown", dyed his hair, darkened his skin, grew a mustache, put on weight and walked with a stoop.

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A draftsman soon forgets the days when he used to wonder where to get a job. Instead, he asks "What line of work interests me most?" And "What part of the country suits me best?" Twenty of my graduates went to Florida this year; three are in Japan; last month one wrote me from Ceylon. And I wish we had the count of how many Dobe draftsmen have become chiefs!

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## Marvels of 1927

(Continued from page 22)

how to cross plants so as to produce the forms desired with greater certainty.

A plant sometimes, apparently accidentally, produces a single branch different from all the other branches. These are called bud sports. Many fine forms of ornamentals and some of our good fruits originated in this way. Some one will learn why nature occasionally produces such bud sports, and be able to induce her to produce them frequently.

We may look for better insecticides and fungicides for controlling insect pests and plant diseases. Advances are also due in the application of the remarkable effects of ultra-violet rays to plant growth.

## Metals

COLIN G. FINK, Ph.D.

Consulting Metallurgist; Professor of Electro-chemistry,  
Columbia University



**THE** nonferrous metal industry, in particular copper, tin, zinc, lead and aluminum, was unusually prosperous during 1926 and there is every indication that this prosperity will continue into 1927.

About 55 percent of the world's copper is furnished by the United States, about 20 percent by Chile and Peru. The Chile Copper Company has almost completed the enlargement of its reduction plant, increasing the annual capacity from 120,000 tons to 175,000 tons.

The consumption of copper has increased astoundingly during the last few years. It is being used in increasing quantities for roofs, leaders, tanks and other chemical engineering apparatus.

As regards aluminum, new fields of usefulness have been opened up by applications in railroad equipment, as well as in the airplane and automobile industries. For the lead industry, also, the outlook for 1927 is most propitious.

## Steam and Power

WILLIAM D. ENNIS, M.E.

Consulting Engineer



**NOTHING** has gone up in price faster or farther than coal: yet power is almost the only thing which is no more expensive today than it was fifteen years ago. Improvements in power production have been gradual and not spectacular. This is the prospective progress for 1927.

The year 1927 should see continued applications of pulverized coal and further improvement in the scientific design and application of furnaces and stokers, and probably in air preheating.

We shall continue to build larger power stations and larger generating units. The year (Continued on page 141)

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## Marvels of 1927

(Continued from page 140)

will see the manufacture of a single unit of 251,000 horsepower, to be installed in New York City in 1928. Another contract recently let was for a unit of 279,000 horsepower.

## Meteorology

CHARLES FITZHUGH TALMAN  
U.S. Weather Bureau, Washington, D.C.



**METEOROLOGY** is looking up. Its attention has been centered of late upon the higher levels of the atmosphere; the domain of meteors and the aurora, of ozone and the Heaviside layer. We may expect news from this region

during the year.

Perhaps the "break" will be the outcome of researches at the U. S. Bureau of Standards on the spectra of the atmospheric gases under the extreme physical conditions supposed to prevail miles above the earth. Perhaps it will come from studies abroad on the abnormal audibility of distant explosions. Perhaps Professor Goddard, of Clark University, will perfect his long-awaited rocket.

Transmission of weather maps by radiotelegraphy may produce in 1927 a daily "mosaic" weather map of the northern hemisphere. This map will be readily available everywhere, by land and sea—an epoch-making advance over the present plan of transmitting merely numerical data, from which the maps must be drawn.

Thanks to Congressional action, the Weather Bureau enters 1927 with twenty-two more pilot-balloon stations than it had a year ago, and will provide adequate meteorological information for aviators along commercial air routes. A novelty of the year will be the use of luminous balloons for observing the upper air currents by night.

## Mathematics

CHARLES LANE POOR, Ph.D.

Professor of Celestial Mechanics, Columbia University



**THE** most important advance in mathematical research in 1927 should be the clear perception of the limitations of mathematics; the recognition that mathematical processes merely constitute a sort of specialized shorthand, that they furnish simplified

methods for arriving at complicated deductions from stated premises.

The great advance in mathematics will be the return to sane and logical thinking; will be the clear recognition that the laws and processes of nature are independent of the mathematician and his processes, and the recognition that one cannot change the law of gravitation by the transformation of a mathematical formula.



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## Here Are Correct Answers to Questions on Page 48

1. The oldest living trees are thought to be the famous giant redwoods in California. A number of these trees are 300 feet tall. Some of them have been cut down, and the annual growth rings in the wood indicated ages as great as 3,000 years.
2. The majority of storms that sweep across the country come from the northwest. They enter the boundaries of the United States either across western Canada or through the states of Oregon and Washington. Over the western part of the country the usual storm path is southeast. In the Mississippi Valley this changes. The path swings around toward the northeast, so that the storms leave the boundaries of the country somewhere in New England or New Jersey and pass out into the North Atlantic Ocean.
3. There are two kinds of food that are great heat producers for the human body. One of these is fat; the other is sugar. Since very little sugar is available to the Eskimos, their diet is composed largely of fat, which gives them the body heat they need.
4. This was a custom of the Aztecs in Mexico and of the earlier and greater people, the Mayas of Guatemala and Yucatan. Before the conquest of Mexico by the Spaniards, human sacrifices were made in the great Aztec temple of the City of Mexico, the victim being killed with a sacred knife made of sharp stone.
5. England is as far north as Labrador. It would have about the same climate were it not for the warming effect of the Gulf Stream. Anything that closed the channel through which the Gulf Stream flows north of Cuba might alter the course of the stream and make the British climate colder.
6. In Panama, Colombia and Venezuela, where a variety of ants cut fragments of leaves and carry them into their nests. On these leaves the ants deposit the spawn of mushrooms. When the mushrooms grow, they are used as food for the baby ants.
7. The British Museum in London.
8. This term comes from the countries of Senegal and Gambia, West Africa, once prominent for the shipment of slaves to other parts of the world.
9. We are not certain whether the first boats large enough to be called ships were built by the ancient Babylonians or by the ancient Egyptians. About 700 years B.C., Pharaoh Necho sent an expedition by ship clear around Africa. As much as 1,000 years before this, ships were probably in use by the Egyptians. Models of the boats used on the Nile have been found in ancient Egyptian tombs.
10. In several countries, notably in India and in China, farm land is at such a premium that the natives have been driven to cultivate the slopes of steep hills. To keep the soil from washing off these slopes, the farmers build numerous small stone walls behind which the slopes are leveled into terraces. This makes a mountain slope look as though it were carved into the steps of a giant staircase.
11. Probably the ape-ape plant, that grows in the Hawaiian Islands. The leaves are shaped somewhat like the leaf of a common geranium, and are sometimes five or six feet across.
12. Probably the Hawaiian Islands. Botanists have found on these islands nearly 700 varieties of plants not found anywhere else. The reason is, apparently, that the islands are far from other land and have been isolated in this way for many geologic ages.



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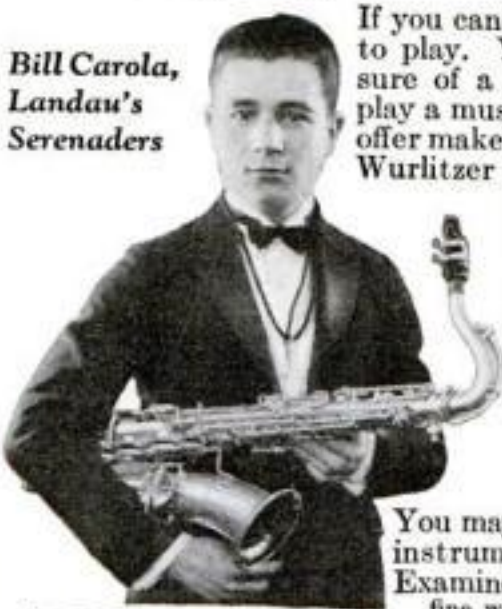
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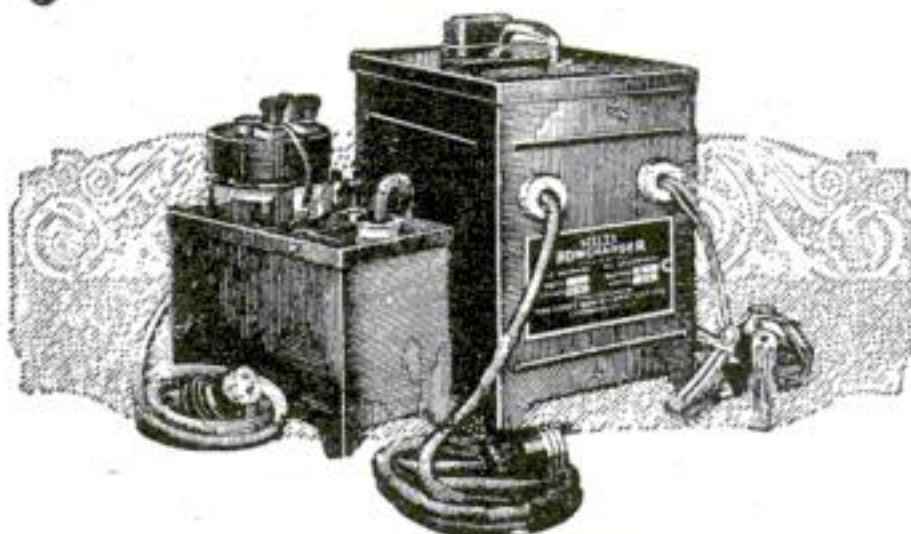
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**HAS NO EQUAL FOR TONE, VOLUME, DISTANCE.** North Wildwood, N.J. Miraco best packed set I ever saw shipped. Words cannot express the wonderful tone quality volume, and distance. First night received 47 stations on Loudspeaker. Up to last night, the 5th day, I have received exactly 100 stations; farthest is KGO, Oakland, Calif. on loudspeaker. Also Porto Rico, Cuba and Canada. Francis B. Lee.

**WISCONSIN HEARS COAST TO COAST.** Racine, Wis. I got station ELO London last Wednesday night on my Miraco. Heard a choir sing and announcement. Have also heard F.W. Havana, Cuba; CYZ, Mexico City and 104 American stations from coast to coast. Lawrence Rieberg.

**SELECTIVITY—CUTS THROUGH STRONG LOCALS.** Detroit, Mich. I am more than satisfied with my Miraco. I can cut through WJW, WCK, WJR, WGHP, very strong local stations, and this is done with quarter of a turn. In every way it is simply perfect. Charles Paul.

**UTAH ENJOYS COAST TO COAST PROGRAMS.** Heber City, Utah. The Miraco sure can't be beat at any price. Coast to coast it sure does and more. I have had stations in New York and Cuba in the east, and scores of other stations on the west coast. I have logged up to date 160 stations and they all come in wonderfully. Monte Giles.

**MIRACOWINS AGAINST 3 OTHER MAKES.** Pearland, Texas. I tried three other makes and the Miraco is the best of them all. Received KFI, Los Angeles, Calif. on loudspeaker. O. H. Richards.

**Neogoches, Texas.** On my Miraco I have heard stations from Cuba to San Francisco and from Mexico City to Pittsburgh. Walter M. Frisbie.

**COAST TO COAST LOUD AND CLEAR.** Guthrie, Minn. We logged over 90 stations and got over 1500 miles on the loud speaker on the first night—our first experience tuning a radio. The third night we got WJAX Jacksonville, Florida and KFI Los Angeles, Calif., on the loudspeaker. Neighbors say Miraco is the best they have ever heard. O. H. Wolf.

**MIRACO BEATS A SUPER EIGHT.** Cobalt, Ontario, Canada. Miraco is one of the best radios in all the north country. There is a man here who has a big Super eight and our Miraco beats it. W. Hamner.

**MOST SELECTIVE—SUPERIOR TO \$120.00 SET.** Santa Cruz, California. I do not hesitate to show my friends the "Miraco Superiority" over my (name another set) costing \$120.00. The Miraco is the most selective set I have seen yet and cuts out the jumble of stations on the low wave lengths in 1 1/2 points. Wm. Schmette.

**MELLOW TONE—LOUD AND CLEAR.** Indian River City, Fla. A wonder set. Am having splendid results. Have had Miraco four nights and have stations on my list from Cuba to New York, Chicago, Denver, Texas, all coming in loud, mellow in tone and clear. I have one sold already and did not even try. Mr. H. G. Duff.

**REFUSED TO TRADE IT FOR EXPENSIVE SET.** Prosper, Ore. Over 31 stations brought in first night on loud speaker. I ordered the Miraco for a friend and he is more than pleased. I offered to trade my Neutrodyne for it but he refused and it has the name of the best set in the community. M. E. Huston.

**PENNSYLVANIA BEGINNER GETS 'EM ALL OVER.** Corty, Pa. Have had Miraco one month today and have received over 110 stations from all parts of the United States, Canada, Cuba, and Mexico.

**LIKES IT BETTER THAN \$150—\$250 SETS.** Westville, Ill. Miraco sure is a wonderful set. I get the stations easily without noise—that's one of the things I like about the Miraco. I've had three other sets that have ranged from \$150 to \$250 each but Miraco beats them all. My friends all like the Miraco. I have had stations all over the U.S.A. I tune in Mexico City and Havana, Cuba any time they are on the air. Alex Klander.

**BEATS COSTLIER SETS WITH MORE TUBES.** Lexington, O. I have given Miraco a thorough try out and find it to do all you claim. 85 stations logged so far; getting new ones every week. This includes coast to coast, Canadian, Cuban and Mexican stations. The selectivity is remarkable. Others here in town have more expensive and elaborate sets with more tubes but do not ever do this. Fuller Temple.

**MIRACO OUTPERFORMS THEM ALL.** St. Francis, Kansas. I've heard a lot of radios but the Miraco is best all around. I am proud of mine. Comes in fine and clear. No noise. Get lots of distant stations. Surely am satisfied. Orvey Sharpe.

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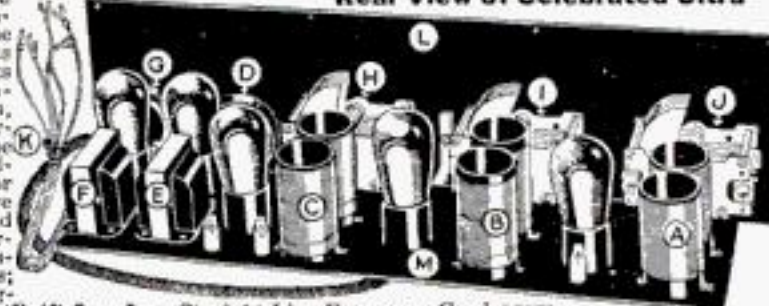
**RELIABILITY!**  
The Midwest organization was one of the very first to engage in the manufacture of radio sets. We consider them to be both morally and financially responsible. They have a reputation for fair and square dealings.—THE PROVIDENT SAVINGS BANK & TRUST CO.

**Factory Prices Save You Up to 1/2!**  
Save or make a lot of money on sets, speakers, tubes, batteries, etc., by getting our Amazing Special Offer. Wonderful bargains! Everything we sell is high-grade. Don't confuse Miraco's with small cheap radios. Satisfaction unconditionally guaranteed.

**You'll Be Proud of a Miraco!**

Yes, you'll be proud to have friends see and hear your Miraco in its big, handsome, expensive-looking solid walnut cabinet with sloping front. In construction and performance too, every inch a high priced set. Handsomely gold illustrated genuine Bakelite front panel finished in grained walnut. Finest parts obtainable—the kind used in \$200 sets. Many exclusive features. Each Miraco reaches you completely assembled, rigidly tested, splendidly packed and factory guaranteed for one year. Easy to install and operate—full instructions supplied. Send NOW for testimony of nearby users and Amazing Offer!

**Compare the construction with highest priced sets—study this picture**  
Rear View of Celebrated Ultra



Note the neat sturdy high-class construction; wide spacings between parts eliminate losses and interference. All wiring concealed under genuine Bakelite base panel (M). Flexible wiring prevents broken or noisy connections. Flush-type sockets for the new tubes. (A) (B) (C)—"Duoformers"—famous exclusive Miraco Ultra low loss, self shielded and matched coils—one of the Miraco secrets of selectivity with powerful volume on long distance stations. (D) "Counter Balancer"—patented feature, NOT a rheostat or potentiometer. Controls oscillations on all wave lengths, reduces "B" battery consumption and further increases selectivity, distance range, clarity, power and volume. (E) (F) Shielded transformers of famous make evenly amplify all notes; beautiful tone quality. (G) Tone Modulator—regulates volume, switches current off or on. (H) (I) (J) Low Loss Straight Line Frequency Condensers—highest grade—equipped with ball bearings. Solid brass plates. Evenly separate all stations. (K) Connect E-Z Cable for attaching batteries. (L) Genuine Bakelite front panel. And many other latest features of costliest sets. Literature describes them fully, send for it!

**All the Proof you want is waiting for You!**

Coupon or postal brings reports from hosts of users in your vicinity and elsewhere proving that Miraco sets at rock-bottom money-saving factory prices, outperform sets costing up to four times as much. You can also buy speakers, tubes, batteries, etc., at big savings from us! Get our proposition before spending money elsewhere.

**MIDWEST RADIO CORPORATION**  
Pioneer Builders of Sets

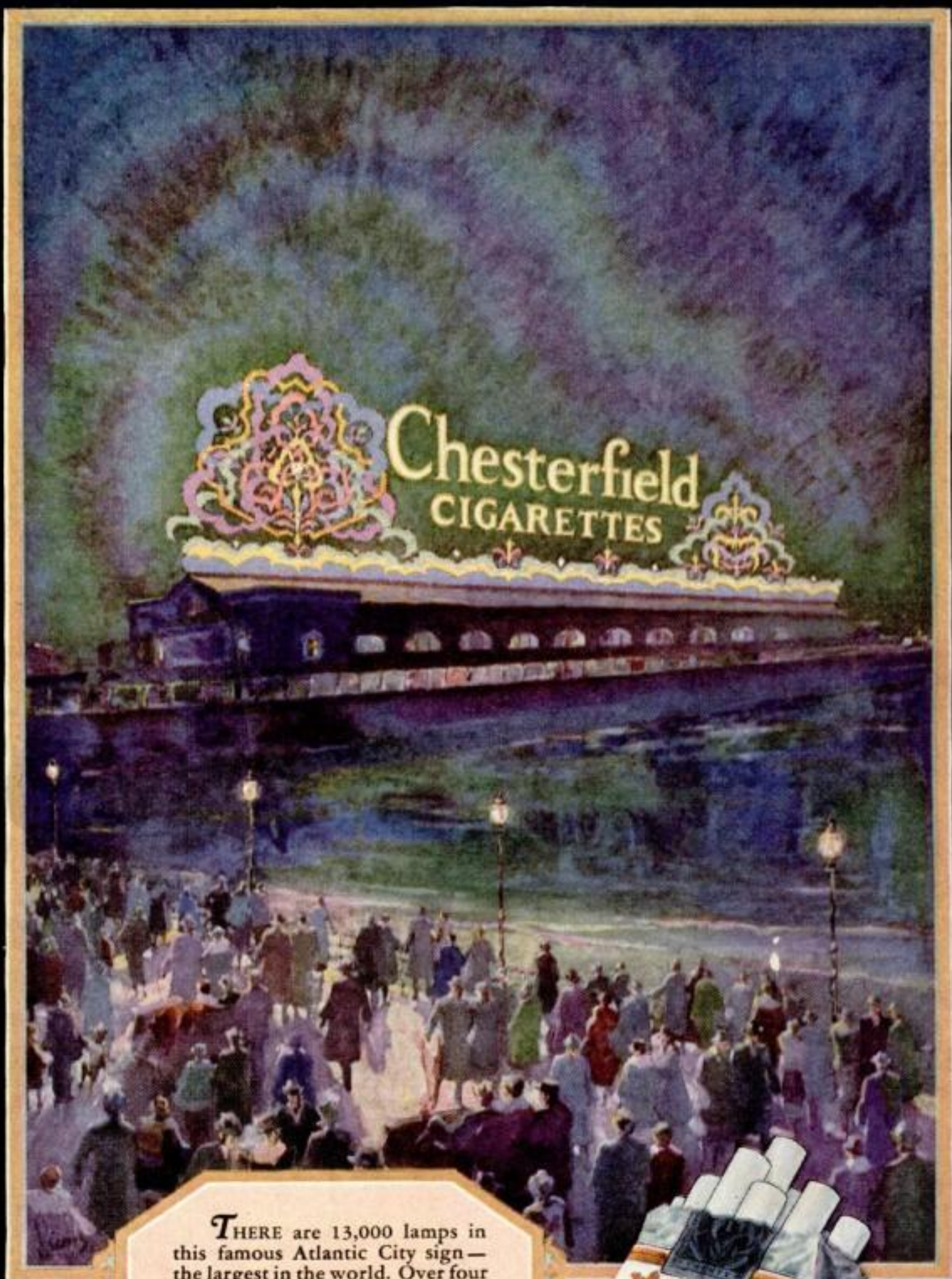
408-S Miraco Building  
Without obligation, send free literature, testimony of users, AMAZING SPECIAL OFFER and full particulars of your big money-saving factory-price proposition on Guaranteed Miraco sets and all radio supplies. ( ) Dealer ( ) Agent ( ) User

NAME  
ADDRESS

AGENTS! Write for proposition. Nation-wide popularity, superior performance, amazingly low prices, make Miraco easy to sell.

This Coupon is NOT an Order





**T**HERE are 13,000 lamps in this famous Atlantic City sign — the largest in the world. Over four times that many Chesterfields are smoked every minute of the day.

SUCH POPULARITY  
MUST BE DESERVED

